

Hayes

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FIRE CONTROL HANDBOOK
PART II

FOR USE AT FIELD STATIONS -
TO BE PLACED IN THE HANDS OF ALL MEN ENGAGED IN
FIRE CONTROL WORK WHILE ACTUALLY
ON THE JOB



Region One
1936

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FOREWORD

This Handbook deals with fire control exclusively. Place it with all employees who have responsibility for fire control duties of any kind. It shall govern in determining standards of performance in the various jobs, both by the men who do the work and by those who direct, supervise and inspect it.

Regardless of the manner of expression used, which in this Handbook has purposely been made terse and pointed, it is understood that the practices enumerated are things which are to be done or known or avoided, as the case may be, and against which men's work will be checked and their qualifications rated. Some things may seem of minor importance, almost trivial in fact, but it is to be remembered that big jobs are the sum of little things and that big issues often turn on success or failure in the handling of details.

The practices listed here represent the best thought and judgment of men of long experience. Each item has been carefully weighed and checked for its soundness and value in fire control work and in the whole job of administration, protection and utilization of National Forest resources. However, no set of instructions and specifications covering a field so broad with conditions so varying as are found in this Region can be complete in detail when applied to each individual job. Supplemental instructions will, therefore, be issued to meet the full requirements of each man's position.

Each employee having fire control duties of any kind shall familiarize himself with and carry out all the instructions herein pertaining to his jobs, and cooperate fully with every other member of the organization in the prevention and suppression of fires. Loyalty, teamwork, speed, will, and a determination to get every fire will go far toward gaining mastery over fire.

These instructions are divided into several parts: general instructions applying to all employees, job requirements, instructions applying to special classes of work, methods, techniques, etc.

ATTITUDE TOWARD PUBLIC

More visitors use the National Forests each year. Unless they know the danger and how to handle fire safely, the number of man-caused fires will increase.

It is the duty of every employee to greet visitors cordially, and to teach safe fire habits. Make opportunities to meet and teach the maximum number of people.

This may be accomplished by:

Making contacts with all Forest visitors in a helpful, cordial, courteous manner.

Teaching unskilled campers where to build fires and how to handle fires safely.

Informing visitors of the fire danger and of any restrictions that are in effect at the time.

Teaching safe ways of handling lighted matches and burning tobacco at times when smoking is not prohibited.

The employee who is successful in this line of work is performing a far-reaching service in the conservation of Forest resources.

SMOKING

Fire set by careless smokers have been responsible for the greatest percentage of man-caused fires. They are on the increase. Prevention measures, earnestly and aggressively executed, are called for.

Employees are expected to:

Know rules that apply and where - abide by them strictly.

Know how to handle matches and tobacco with entire safety.

Inform Forest users regarding restrictions and instruct them in safe use of smoking materials when smoking is allowed.

Gather evidence and report violations of smoking restrictions.

During closed season smoking permitted only in:

Places of habitation.

Areas within fire line.

Over-night camps.

Sites posted for camping use.

Sites previously posted for smoking.

LAW ENFORCEMENT

One of the most effective means of reducing man-caused fires is through strict enforcement of Fire laws and Forest regulations.

It is the duty of every Forest employee to:

Familiarize himself with Fire laws and regulations of the Forest Service and state of his assignment. (See R1 - Law Enforcement Manual.)

Tactfully inform the public concerning same.

Determine identity of individual guilty of infraction.

Make notebook record of names and addresses of responsible parties, witnesses, car number, measurements, dates, hour, etc., and statements of possible witnesses. Collect evidence such as papers, food containers, cloth, other discarded articles, etc. at or near the spot.

Record measurements or peculiarities of foot prints, or car tracks.

The ranger will furnish employee with information on State and Forest laws and regulations applying to particular area concerned.

FISH AND GAME

The management of fish and game is one of the major Forest problems requiring the best efforts of every employee.

Each employee is expected to:

Become familiar with Fish and Game laws and regulations of the state of his assignment.

Obey them to the letter.

Obtain detailed evidence pertaining to any violations coming under their notice.

Immediately report infractions to superior officer.

Make detailed note book record of facts at time investigations are under way or as observations are being made or come to attention. See Law Enforcement Handbook.

Not let fish and game activities take precedence over fire control duties.

SANITATION - HEALTH

Forest Service employees shall set a high example of cleanliness and sanitation practices for all Forest users and keep themselves physically fit.

This applies at:

Headquarters	Habitations
Any cabin	Tent camps
Lunch places	Camp grounds
Other occupied sites.	

Standards require:

Personal neatness.	Fly-tight pits and garbage cans.
Neat and appropriate clothing.	Station grounds cleared of all rubbish.
Shave at least every second day.	Sweeping out daily.
Clean towels.	Airing bed and quarters weekly.
Keeping fit, exercising regularly.	
Regular well-cooked meals. (Poor cooking is inexcusable.)	
Ample garbage pit 100 ft. or further from kitchen, current disposal therein.	
Frequently disinfected toilets and garbage pits.	
Clean windows.	Orderly housekeeping generally.
Washing dishes directly following each meal, and rinsing in clear, hot water.	

REDUCTION OF FIRE DANGERS

Stoves -- Cautions:

Not less than 18 inches from any wall.
Metal underneath extending 18 inches in front of fire box.
Ventilated space of at least four inches between stove and floor.
Close tightly before leaving.
Dump ashes in prepared and safe spot, out of sight of grounds and six feet from any inflammable material.

Bottomless fire boxes are dangerous any place.

Give an oiled coat, store in dry place at end of season.

Powder and Caps -- Cautions:

Pad well for packing or hauling. Mark package plainly. Box and handle separately. Store separately in cool, dry, isolated well-marked place, at least 300 feet from other buildings.

Keep safe from stock, game or rodents.

Use of fuse prohibited during Class 4 or higher fire danger.

Pipe, Stove -- Cautions:

Provide standard screen or spark arresters. Keep all joints tightly fitted. Joints shall be riveted where practicable. Replace rusted joints promptly.

Project not less than 2 ft. above ridge pole or roof comb, anchor securely.

Keep one foot from walls and 3 inches from roof or ceiling.

Use standard roof jacks and wall and ceiling drums.

Oil and store in dry place in fall. Put cap on roof jack at end of season.

Chimneys Dangerous When:

Cracked

Not cleaned

Leaning

Not 2 ft. above roof comb

Unscreened

Pipe openings uncovered

Concrete

Supports are weak.

(Inspect monthly and repair as deficiencies are found.)

Gasoline, Oil, Coal Oil:

Store in cool, dry place, 100 feet from occupied buildings.

Do not smoke or permit exposed flame near these.

Oil or Paint Rags:

Burn up in stove immediately after use to avoid danger of spontaneous combustion.

Matches:

Place in covered glass or tin container. Keep out of sunlight and away from stove.

Glass:

Sometimes focuses sun's rays causing fire. Dispose of bottles and broken glass by burying.

Roofs. Keep free of:

Cleats, ladders, or any objects that collect moss, leaves, needles or other inflammables.

Burn Rubbish:

By temporary employees only when approved by ranger.

Only in prepared spots cleared of all fuels for a distance of 8 ft. on all sides.

Only during safe weather. Extinguish all embers before leaving the fire.

Camp Fires:

Locate in open ground. Clear ground three feet on all sides of fire.

Build only large enough for actual need, in hole dug for the purpose.

Must be attended by someone at all times.

Put dead out before leaving. Mix with water or dirt, stir and re-mix, feel with hands.

Car Muffler:

Cars and trucks must be equipped with standard mufflers, and no cut-out used.

Moulding Hay or Manure:

May be a breeding place for flies or cause spontaneous combustion.

Dispose of by burning if possible - if not haul or carry to shaded place out of sight and scatter thinly.

TOOLS AND EQUIPMENT

The employee is responsible for all tools and equipment assigned him.

Report: Losses, breakages, worn out ones at once.

Hold: Worn out and broken equipment for condemning by Forest officer.

Cutting Tools and Misc.

Keep sharp and under shelter at all times. Metal parts clean, oiled.

Handles protected from rodents, do not use handles as pry poles.

Tentage:

Set up neatly.

Dry before storage.

Store in dry place protected against attack by rodents.

Top level.
Ropes tight.
Walls straight.

Equip with asbestos rings or metal roof jacks.

Bottom free from ground.
Avoid sharp objects.
Protect from stove, pipe.

Fireman Equipment -- Keep:

Always in assigned place.
Intact and tagged.
Light always ready.
Safe from rodents and insects.

Tools sharp and clean.
Rations complete and usable.
Use only on fire.
Replaced or reconditioned immediately after using.

Water Bags:

During fire season keep soaked at all times and change water frequently.
When filled, hang up.
Protect from sharp instruments.

Dry before storage.
Store in dry place.

Kitchen Equipment:

Wash and dry after use.
Rinse off soapy water before drying.
Neatly put away after using.

Coated with mineral oil for winter storage.
Store in dry place.

LIGHTS

Listed below in their respective order of preference are the various kinds of lights now in use by fire control forces. As rapidly as possible the less desirable types are being replaced by the more satisfactory electric flashlight type:

1. Electric flashlight (headset type).
2. Palouser (can and candle).
3. Stonebridge lantern (candle type).
4. Carbide lamp (Miners').
5. Mantle lanterns, gasoline (for camp use only except in an emergency).

USE AND CARE OF LIGHTS

Keep extra set of batteries available. Keep extra bulb in bulb clamp in rear cap. Prevent accidental battery drain by fastening a piece of stiff cardboard over contact button with a piece of adhesive tape or by removing batteries when storing light in pack or tool cache.

Keep connection nuts tight on headset. Roughen threads or swadge slightly to prevent loss of nuts.

Never leave batteries in case over winter.

Palouser:

Carry extra candles (plumbers'). Use a wire bail for convenience in carrying.

Be careful of shortened candles so that they do not drop out and start a fire.

Stonebridge Lanterns:

Carry extra candles (plumbers').

To clean mica windows clean in very hot soda water or use kerosene and rag.

Do not try to fold up wrong way.

Carbide Lamps:

Fill Lamp Bottom 2/3 full of carbide.

Use Miners' size carbide (1/4 in.).

Set Valve Lever on notch marked "Off."

Open cap on top of lamp and fill Water Container full of water.

Screw bottom on tightly. Turn water on slowly by turning lever to left 2 or 3 notches and permit the air in the lamp to escape through the tip for a few seconds; then light with the Lighter attached to the Reflector.

TO LIGHT--Cover the reflector with palm of hand, hold a few seconds, then draw the hand downward quickly. Rubbing the hand over the wheel makes a spark which lights the gas. If hand is held too long, a loud report is produced but does no harm.

When lamp has been lighted, regulate flame by turning lever which controls the flow of water into the carbide 1 or 2 notches at a time. Do not flood your carbide as your lamp will not burn properly.

Keep your lamp clean when not in use. Use new felt when the old one becomes hard. Clean tip with special No.37 Tip Cleaner or with a strand of emergency wire when necessary. When through using the lamp, do not let the flame burn out-this clogs the tip with carbon. When the flame begins to die down after water has been turned off, blow it out.

Mantle Lanterns:

Always use transparent mantle protector globe and metal lamp top provided with each light.

Preheat generator tube thoroughly before turning on gas.

Never fill gas reservoir over 2/3 full with gasoline as air space must be left.

Never open refill cap with lamp lighted, in a closed room with an open flame therein, or near an open flame anywhere.

Replace broken mantles as soon as possible.

Clean generator tips only with special cleaner provided or with a fine emergency wire strand.

Extra generators, mantles and gasoline should be kept available.

Do not use colored gasoline of any kind as it will soon plug generators.

Hi-test or aviation gasoline is best suited.

Never try to light a lamp or lantern upon which new mantles have been placed until the wax has been completely burned off.

TORCHES

Whatever method is used in controlling a fire, a certain amount of burning out may have to be done for the sake of safety. Torches are generally faster and more effective than firing by hand and are provided as a means of speeding up the work.

Two pressure torches are in use in the Region, the Propane torch and the Hauck torch.

The Propane Torch

Propane is a liquefied gas which is highly inflammable when released from pressure. The Propane torch unit comprises a heavy cylinder and a burner connected by hose and tubing

The cylinder is fitted with a valve and the tube above the burner with an operating valve. The cylinder or tank is strapped to a pack frame for back-packing. To use the torch, the valve on the cylinder is first opened and then the gas is released into the burner by opening the operating valve. The torch must be ignited at the extreme end of the burner. It cannot be ignited through the holes in the sides. Full instructions are packed in the box with the torch. If they are followed no difficulty will be experienced in operating the torch.

Propane torches are supplied in each complete 25-man fire outfit sent out from Procurement and Supply warehouses.

The Hauck Torch

Many of the 25-man fire outfits stored on the Forests in the Region include Hauck torches instead of Propane. Hauck torches are also available upon requisition from Procurement and Supply.

The Hauck torch burns kerosene or gasoline and operates much as a common blow torch does. The burner must be heated until it is almost red hot. This is best done in an open fire. Instructions for the use of the torch are attached to each unit.

The flame of the Hauck torch is not as hot as that of the Propane and it has the added disadvantage of the necessity for heating before using.

Fusees

Each 25-man fire outfit includes a box of 12 fusees.

A fusee burns for 10 minutes with a fairly hot flame. A sharp spike in one end can be forced into the end of a pole if it is necessary to reach up to burn moss from trees. Their best use is in igniting small, unburned patches inside the fire line, when it is not convenient to carry or have available the large torches.

A cap on the burning end of the fusee must be removed before using. The cap contains a substance which when rubbed across the top of the fusee ignites it.

CARS AND TRUCKS - GOVERNMENT OR PERSONAL

If used for fire shall be ready for instant get-away, and have:

Tires inflated to prescribed pressure (See Table in Appendix).

Gas tank full.

Oil level up.

All lights working.

Grease-oil card on hand and up to date.

Card of instructions at hand.

Accident report forms in car.

Shovel, axe, and water bucket.

Car jack, tire pump, repair kit and flares.

Spare tire, and air up.

Brakes in perfect working order.

License plates firmly attached and clean.

Battery fully charged.

Bearings greased.

All bolts tightened.

Driver Must:

Observe traffic and speed regulations.

Drive cautiously on curves and elsewhere.

Promptly report any accident on form provided.

Know that he may be held liable for damages resulting from accidents.

Be considerate and courteous to others.

(See instructions to truck drivers, Form 118-R1.)

FOOD SUPPLIES

Arrangements will be made to:

Have camp stocked on occupation for period of expected use.

Replenish through requisition from district headquarters. (This will not generally be at frequent or regular intervals.)

Order ahead of actual want.

Inventory supplies frequently, keep want list.

Send surplus items back to central storage warehouses.

Prevent waste of food.

Store neatly in cool, dry, protected place.

Keep away from animals, rodents and flies.

Temporary men, fire guards, lookouts, etc. shall not be permitted to absent themselves from their station to go after food supplies.

IMPROVEMENT WORK

Improvement work is an essential part of the fire control employees' duties. Do not permit maintenance and construction jobs to interfere with fire control duties. During periods when the fire danger class rates 3 or higher, the district ranger is responsible for seeing that this does not happen. Men with fire duties will leave their stations or engage in other than fire duties only under specific instructions issued daily by the ranger, or by his alternate or dispatcher when either of them has been designated by the ranger to issue such instructions.

COMMUNICATION -Telephone-

Installation

1. Fasten up with screws.
2. Check batteries, must be initialed and dated when installed.
3. Don't replace a single battery, put in an entire new set. If new ones are not available use only the good ones until replacement can be made. Destroy all useless batteries. Save weakened batteries for mapboard lights.
4. Check wiring of batteries, tighten connections.
5. Check all phone connections, must be clean and tight. Old connections often work loose or corrode.
6. Main and ground wire connections must be soldered or clamped.
7. All wiring properly insulated.
8. Place protectors so printing is right end up.
9. Drive ground rod full length in moist earth, as nearly direct under protector as possible.
10. Up to date call card posted at telephone.
11. Clean contacts on knife switches with cloth.

Telephone Maintenance

1. Telephone bell does not ring or rings faintly when others call:

- (a) Line wire, drop wire or lead-in wire is broken.
- (b) Short circuit in lightning protection. Disconnect protection from rest of circuit, or pull out protector tube.
- (c) Line wire may be grounded, by resting on ground.
- (d) Broken wire or connection in telephone set.

2. Bells ring frequently without apparent cause:

- (a) Swinging cross with telegraph or telephone line.

3. Bells at switching station all ring when calling on only one line:

If all bells ring, even when switches are open and no cross exists between the lines:

- (a) Poor ground. Change location or saturate ground around rod.
- (b) Too high resistance of wire leading from ground, due to wire being too small.

4. You cannot ring bells of other telephones:

- (a) Line wire, drop wire or lead-in wire broken.
- (b) Fuse open. Replace or short circuit wire across fuse connections.
- (c) Grounded line wire. (Line wire touching or buried in the ground.)
- (d) Short circuited protector blocks. Disconnect protection unit and wire around it.
- (e) Poor ground. (Not thoroughly soaked around ground rod.)
- (f) Broken wire or connections in telephone set, repair break.

5. You cannot make others hear you talk:

- (a) Batteries weak or improperly connected.
- (b) Switch hook out of adjustment or contacts are poor.
- (c) Check wiring connections, clean and tighten.
- (d) Transmitter is packed. Rap sharply with the knuckles on side of transmitter.
- (e) Receiver or receiver cord is open. Connect one end of receiver cord to a battery and click should be heard when other end is touched to opposite battery post, if okay.

6. You cannot hear others talk:

- (a) Defective or dirty receiver, remove cap and clean, tighten connections.
- (b) Receiver open or short circuited. Same test as above.
- (c) Switch hook out of adjustment, adjustments of springs are necessary but must be carefully made.

7. Your conversation is interrupted so that you only hear parts of conversation:

- (a) Loose connections on line or ground wire, tighten joints.
- (b) Line wires crossed or grounded intermittently, separate.
- (c) Line wire swinging against lightning rod on poles.
- (d) Receiver cord partly broken - test with battery, (see above). Replace cord with two insulated wires.
- (e) Loose connections in batteries or set, tighten connections.
- (f) Loose connection between lead-in and drop wire, solder connections.
- (g) Unsoldered connection at ground rod, resolder or use clamp.
- (h) Bad splice in line wire, cut out and make standard.

8. Generator turns hard:

- (a) Line wire grounded.
- (b) Protector blocks grounded - remove from circuit.
- (c) Protector shorted by lightning, remove protector tube.
- (d) Wires crossed, if a metallic circuit.
- (e) Generator needs oil, don't oil it unless you know how.

Line Maintenance

- 1. Don't pull up a tree line too tight when making repairs.
- 2. Rehang line at same height as original construction, 15 or 18 feet above ground.
- 3. Remove brush and limbs that touch the line.
- 4. Keep spans even and wire free of all contacts.
- 5. Replace broken insulators.
- 6. New poles set must not be less than 7 inch top diameters.
- 7. Check poles and guy wire to make sure they are substantial.
- 8. Remove poor splices from line. Old splices frequently work loose and cause a high resistance.

9. Don't make permanent connections between lines or change phones from one line to another without approval of district ranger.

Telephone Don'ts

1. Check wiring in the telephone set but don't attempt to take it apart internally.
2. Don't attempt to adjust ringer.
3. Don't oil any part of a telephone except as directed by ranger.
4. Don't blame your set the first time, try again, other party may not be on line.
5. Don't neglect to pour water around your ground rod frequently.
6. Don't experiment with the instrument.
7. Don't leave receiver off the hook, this runs down the batteries.
8. Don't touch the telephone line during lightning storms.

Telephone Use

- (a) Be courteous.
- (b) Listen in before ringing.
- (c) Rubbering interferes with service, it is prohibited.
- (d) Do not use unnecessarily.
- (e) Answer your ring promptly, keep within hearing of phone, unless released by ranger.
- (f) Report promptly on time.
- (g) If unable to ring headquarters, report to your neighbor and have him try for you.
- (h) Be sure drop phones are disconnected before leaving.

COMMUNICATION

-Radio-

TROUBLE SHOOTING

Read the Instruction Manual thoroughly. Trouble is generally outside of the set, so begin checking here. Do not go inside of the set without permission from the Forest officer in charge, and then only after satisfying yourself that the trouble is not outside.

In case of trouble, check the set according to the following outline:

General Trouble:

1. Check voltage of all batteries according to instructions in manual. Check batteries at least once a week and make a report to the ranger regarding their condition.
2. Tighten all battery connections.
3. Check for correct wiring according to diagram in manual.
4. See that battery cable is securely connected.
5. Pull back rubber covering on battery cable connector and see if all contacts are solid.
6. See that antenna is properly installed and connected to set.
7. See that microphone cord is plugged firmly into small jacks marked "Micr."

Transmitter Trouble

1. With switch in transmit position, give the set a sharp rap with the knuckles on the right-hand side of the case.
2. Rap with the knuckles on the door behind the microphone to increase microphone sensitivity.
3. Test lamp may be loose in socket or burned out.
4. Check test light by moving small coil in light circuit on Sp sets. It should light in one position.
5. See if tubes light when set is turned on. Four tubes light in the transmit position and three in the receive position.
6. Be sure all tubes are firmly in their sockets.
7. Try code by plugging in the key. The fault may be in voice end of set.
8. Before going into set, try to make contact on next schedule. Bad atmospheric conditions may be the cause.

Receiver Trouble

1. See that phone plug is inserted in correct jack.
2. Listen to receiver and see if it is operating. The meter may be bad and not functioning.
3. Examine head phones. See if cord is injured. See if connections are tight.
4. Disconnect phone plug and place one terminal of headset cord on a cell of the battery.

Touch other terminal to other battery connection and a click will be heard, indicating that phones are okay.

5. See that tubes are okay.

6. If set still refuses to operate, report it as soon as possible.

FIRE WEATHER

Time since last rain, wind velocity, temperatures, amount of moisture in air, expressed in terms of relative humidity, and lightning, are factors of weather which individually or collectively have a potent bearing upon the probabilities of fires starting and the possibilities of rates of spread of fire. Collection of weather data at ranger or guard stations and Supervisors' Offices, coupled with daily forecasts from the Weather Bureau, make possible a dependable calculation of the probabilities of fire behavior. Many of the guard stations are called upon to report measurements of weather factors such as:

Wind velocity and direction.

Amount of rain and area covered.

Appearance in pending or actual electric storms.

Temperatures and sometimes other factors.

Recordings at ranger station include the above and additional items such as:

Humidity or moisture contents of the air.

Fuel moisture contents of ground fuels.

Sometimes barometer and paired minimum thermometer recordings.

Period since last rain of .2 of an inch or more.

Some of the foregoing and other fire weather factors correlated by the "Forest Fire Danger Meter" are used in determining the class of Fire Danger, as Class 4, 5, 6, or 7.

As called upon to do so fire control employees and improvement men will be expected to carefully and accurately record and report fire weather. The district ranger shall see that his employees are informed of fire danger measurements, and that the significance of the information is understood by his men.

When fire danger of Class 5 or above is recorded, the danger of occurrence and rapid spread of fire calls for special alertness man by man and the best possible effort by all, first to prevent fires, and if any start, to speed up their detection, get-away time, travel time and their control.

Fuel moisture measurements are based on per cent of water per 100 pounds of fuel, meaning that if there are five pounds of water to 100 pounds of fuel such as: duff, twigs and small sticks, it is mentioned as "5% fuel moisture." Blow-ups are most common when fuel moisture drops below 5%. Usually strong winds are required to cause blow-ups when fuel moisture is above 7%. Humidity has a direct relation to fuel moisture and, while not as dependable as fuel moisture readings, may be used to advantage when the latter is not obtainable in determining probable fire action. Humidity fluctuation is apt to be rapid and influenced by changing currents of air or passing clouds while the fuel moisture remains the same or nearly so. Relative humidity which is the percentage of saturation of the air ranges from zero, absolute dryness, to 100 percent or saturation point of the air.

Fire hazards fluctuate with humidity and the following tabulation gives the approximate inflammability according to air humidity.

Humidity

From 0 to 30%	) Extremely inflammable. Fires catch readily and burn fiercely. Wind influences materially.
From 31 to 50%	(Fuels inflammable, fires will catch and gain headway. Wind a material factor in fire action.
From 51% up	) Fires smolder, spread slowly with low inflammability.

Winds, direction and velocity have a material effect on fire action. The forecasts of wind velocity and direction are intended to apply to the Regional winds blowing across the peaks. Down in the canyons both direction and velocity will vary with the eddying currents set up by the topography.

A light wind (rustles leaves) velocity 7 miles or less per hour.

A gentle wind (extends light flag) velocity 8 to 12 miles per hour.

A moderate wind (sways small branches) velocity 13 to 18 miles per hour.

A fresh wind (sways small trees) velocity 19 to 24 miles per hour.

A strong wind (sways large branches and trees) velocity 25 miles and up per hour.

Whenever a fresh or strong wind is predicted, note the direction it is reported coming from and prepare for trouble.

Weather Forecasts for the Western Forests will be made from the Missoula Weather Bureau, and will be based on morning fire weather reports from the Forest recording stations and will be available to each ranger station about noon each day. This forecast applies to a Forest or to a group of Forests and covers the period from 5 p.m. of the day received to the same hour of the following day. It may not fit your particular locality each time but it is a dependable index of what to expect.

Using Knowledge of Fire Weather Factors.

Take advantage of every hour of favorable weather, especially the first few hours after a shower, early morning and cool night hours and cutting fire off from bad fuels.

The best fire boss makes every possible use of weather and fuel type information obtainable. He watches the weather records for fuel moisture and humidity conditions, takes into account wind velocity and direction, the maximum temperatures and the forecasts for the day. It has been learned that bad fire blow-ups, influenced mainly by wind, may be expected to occur every 3 to 7 days.

KNOWLEDGE OF LOCALITY

The ranger will, to the extent possible, distribute pre-season work to employees to assist them in learning their country. He will direct discovery trips, discuss with the employee pertinent points about all areas in question, and indicate on a map or by memoranda helpful information. First hand knowledge is the best.

It is essential for each fire control employee to know his country.

The knowledge required includes:

Roads and trails.

Topography - stream courses, ridges and peaks.

Natural fire-breaks.

Character of timber stand.
Type of fuels in relation to spread of fires.
Special fire hazards - slash, rubbish.
Best routes of travel away from roads and trails.

This information can be obtained through:

Study of maps. Trips into areas.
Information from those who know.

DIARY

Every employee is required to keep a daily notebook record of work and important occurrences. The first leaf shall show:

Name	-	John Doe
Lookout or other	-	Cook Mtn.
District	-	Dixie
Forest	-	Kootenai

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For each day use one or more pages but do not put more than one day on a page.
Head page thus:

Wednesday, July 1.

Lookout Fireman - Sample:

6:00 AM to 6:20 in observatory, looked area over intensively.
7:00 AM Breakfast over, dishes washed and test calls to Bungalow station.
8:00 AM to 1 PM helped Bill Head cut out 10 logs on Trail #10 between mile posts 1 and 4, returned to Cook Mtn. 2 PM.
2:05 PM Reported Bungalow Station. Received weather forecast of probable electric storms. Told by Brown to go on lookout duty.
3:00 PM Thunder clouds appearing over Rockey Ridge, traveling NE wind 15 miles per hour. I reported this in.
3:15 PM Lightning over Weitass Creek with light rain. Several strikes located, recorded and reported to headquarters.

3:45 PM Storm passed over Moose Mtn.
 3:50 PM Richard Roe trail maintainer came in from Indian Grave.
 3:55 PM Thin smoke appeared azimuth 280° Sec. 5, R14 N, T 2W., reported this to Brown, dispatcher at Bungalow.
 4:00 PM Started to fire. 4:08 PM arrived at fire. 5:40 PM corralled fire. Put fire out at 7:10 PM filled out smokechaser report form and left 7:20 PM. Returned to lookout at 9:50 PM reported at once to headquarters. Richard Roe attended lookout duty during my absence.
 Maint. Trail #10 - 5 hours. Fire #8 - 6 hours.
Crew Foreman - Sample Diary
 Chas. Briggs, Trail Crew Foreman.
 7:00 AM Breakfast over, telephone test call made to O'Hara Station, all okey.
 8:00 AM Started 6 man crew rebuilding trail up Ratcliff Creek, 2-men swamping, 4-men grading tread.
 1:10 PM Messenger called crew to O'Hara because of forecasted probable lightning storms.
 2:00 PM Lightning occurring on Coolwater ridge with light rain, fire reported 2:30 PM Sec. 6, T 32N, R 8E, took two men in car left at 2:35 PM. Drove to point 1/2 mile of fire arrived with Short and Jones at fire 3:25 PM. Fire out at 4:10 PM. Made out Smokechaser Report Form 592 on fire and returned to O'Hara 5:30 PM.
 Betterment Trail #43 - 4 hours.
 Suppression Fire #61 - 4 hours 30 minutes.

CARE OF MEN

Fighting fire is both exhausting and dangerous. Safeguarding men from injuries, possibly fatal, and from fatigue due to over-exertion or overheating is a serious responsibility.

The fire boss and the foremen are responsible for taking every reasonable precaution in preventing injuries to the men in their charge. In the face of danger from bad

blow-ups, they must retain self-control, keep calm and do what is necessary to prevent excitement among the men. Ordinarily bad blow-ups may be prevented by keeping informed, by co-ordinating action on all sectors of a fire, and by directing organized prompt dirt-ing-down attacks on hot spots.

In case crews are in a dangerous place on the fire line when the bad burning period of the day is beginning, the fire boss should plan out his line of retreat, and instruct his foremen to watch the action of the fire closely, and if it shows clear signs of blowing up and there is no nearby safe place, crews will be taken at once to a place of safety until the danger period is past.

Aside from the spectacular catastrophe of 1910, more men have been killed or seriously injured through accidents occurring in line construction and mop-up work than from flames and smoke. There is an ever-present risk from falling timber, falling limbs, rolling logs, and rolling rocks that calls for constant watchfulness on the part of foremen and strawbosses. The line worker, from the nature of his job, must depend for his protection upon the watchfulness of the boss, but every worker in a place of danger will be warned and instructed as to precautions he must take.

The more important dangers are:

1. Careless felling of trees.

- (a) Failure on the part of fellers to shout a warning as a tree is about to topple over.
- (b) Felling of trees into other trees without due consideration of the number of trees or snags that may be knocked down and the men endangered thereby.
- (c) Carelessness in bringing "lodged" trees to earth.
- (d) Failure to keep track of the location of other nearby workers.
- (e) Failure to be on guard against "kick-back" of a tree when severed from the stump.
- (f) Failure to prevent bunching of men on the fire line which hinders the get-away from fire danger.

2. Failure to watch the action of burned or burning snags: (Remember that a snag burned off at the ground or higher up usually makes little or no noise until it strikes

the ground.)

- (a) Failure to watch the effect of wind action on snags or green trees that have been burned around the base, and to spot the dangerous ones.
 - (b) Failure to spot badly weakened snag tops.
 - (c) Failure to size up the consequences of a falling snag (flying limbs or chunks of wood from felling of other snags.)
3. Rolling logs on steep slopes.
- (a) Those burning off.
 - (b) Those started by the natural falling of trees and snags.
 - (c) Those resulting from action of men.
4. Rolling rocks on steep slopes.
- (a) Those started by burning out of their supporting material.
 - (b) Those started by falling snags and trees.
 - (c) Those started by men or animals.
5. Careless handling of edged tools.
- (a) Axes glancing or hanging on overhead limbs.
 - (b) Saws--men falling on them or being hit by a saw carelessly carried.
6. Infections resulting from:
- (a) Blistered feet.
 - (b) Carelessly dressed or undressed minor wounds.
 - (c) Burns or scalds.
 - (d) Insect or snake bites and stings.
7. Illness from:
- (a) Lack of sanitation.
 - (b) Too free use of water.
 - (c) Tainted food.
 - (d) Over-exertion, overheating, and excessive perspiration.

These dangers are enumerated here in order that they may the most surely be avoided. The fire boss and the foreman must see that the following precautions are taken:

Provide a third man in each saw crew whose duty shall be to keep a lookout and warn any men apt to be endangered by falling snags.

As far as possible get experienced men into the saw crews and always an experienced foreman or strawboss in charge.

Never allow bunching of men anywhere on the fire line.

Give specific directions to all men in dangerous situations covering their actions both before and after a warning is given by a lookout.

Give specific directions to men in dangerous situation on account of rolling rocks or logs and of burning snags, tree tops and limbs.

Correct dangerous habits in use of tools whenever and wherever found.

Prohibit men working within reach of anothers tools.

When carrying tools require them to travel at least 6 feet apart.. Saws always behind.

Avoid working men over long hours day after day until their physical strength and morale are exhausted.

Provide two lunches on all shifts of 10 hours or more.

Have regulated rest periods where work is arduous and allow smoking inside the lines during these periods.

See that first-aid materials are available both at camp and on the line and apply first-aid promptly.

SAFETY FIRST

A few of the safety first precautions and practical first aid treatments applicable to Forest employees of Region One are given below.

Remember that accident prevention is of primary importance, but that immediate proper treatment of injuries, no matter how slight, is of vital importance.

Shield cutting edge of tools when hauling or packing.

Be careful in use of sharp tools - make sure you are out of reach of others tools and they of yours.

Watch out for overhanging limbs and brush when chopping.

Always use light in rough area after dark.
Drive carefully - take no chances.
Watch out for falling timber.
Sip water slowly when overheated. Never gulp it down.
Properly and plainly label medicine containers.
Be sure iodine is diluted to 3½%. Keep tightly corked.
(Iodine from drug stores is usually 7%. Dilute with rubbing alcohol.)
Do not eat partly decayed food or food of doubtful quality.
Be cautious about eating berries, roots, toad stools, etc.

During Lightning Storms:

Keep away from metallic objects, such as stove, fire finder, telephone, all wiring.

Avoid lone trees or small groups, and exposed ridges and points.

Safest Place: Middle of largest space inside protected building or tower. In basin of heavy timber, in a depression, in a tunnel, or under overhanging bank or rock ledge.

FIRST AID

WOUNDS:

Always give immediate proper attention.
Induce moderate bleeding.
Do not touch with hand.
Apply 3½% solution iodine, once only.
Let dry, apply sterile dressing, then bandage.
Table salt or Epsom salts may be used as disinfectant.

If in need of cleaning, may use:

Rubbing alcohol, turpentine, coal oil, benzine, naphtha or high test gasoline.
Never use water except in case of animal bites, or where skin is not broken, or acid burns.

If artery bleeding Severe:

Firmly bandage large dressing over wound.
Apply digital (finger) pressure over artery.
Apply tourniquet over arterial pressure point. (Never leave tourniquet on over one-half hour without loosening for a few moments.) Failure in this may cause loss of limb.)

INFECTION:

While awaiting physician apply towel compresses wrung out of hot boiled water with 3 tablespoons dissolved table salt or 6 tablespoons Epsom salts per quart. Keep up treatment at least an hour.

BURNS, TREATMENT:

Apply sterile gauze soaked in solution, 1 tablespoon baking soda and 2 tablespoons Epsom salts dissolved in 1 pint warm boiled water. Keep moist.

Get medical aid in case any severe burn, while giving above treatment.

SHOCK:

Immediately follows most accidents, often is fatal, must be promptly treated.

Symptoms: Face pale, cold sweat, skin cold, pulse fast but weak, may have cramps, has "all gone" feeling.

Treatment: Lay down, head slightly lower than feet, (except case of head or upper body injury, sun or heat stroke; in these cases raise head and do not give stimulants.)
Wrap warmly, apply heat to feet, between thighs, beside body, or abdomen.
If conscious, give hot drink of coffee, tea or water, one cup every 1/2 hour.
In case of heat or sun stroke, apply cold instead of heat, and give cold drinks.

POISONS - INTERNALLY:

Immediately and repeatedly induce vomiting by giving one of:

- (a) Soap suds, ordinary soap.
- (b) Salt water.
- (c) Soda water, use baking soda.
- (d) Dishwater, lukewarm water.

If necessary tickle back of throat with finger.
After stomach is thoroughly washed out give large dose of Epsom salts.
After above treatments, drink cows milk if available.

POISON IVY, SUMAC OR OAK:

Avoid contact especially when perspiring.
Wash exposed parts with warm soap suds, then if available, cleanse with rubbing alcohol.

TREATMENT OF SKIN POISONING:

Wash with warm soapy water, then cleanse with rubbing alcohol if available.
Apply thick paste of soap, leave on overnight or apply dressings frequently moistened with Epsom salts dissolved in cold water, 2 tablespoons to pint.

SNAKE BITES:

Precautions:

Wear protective coverings such as leather.
Avoid vicinity snakes' dens.
Where poisonous snakes are numerous, carry a club.
Beat brush, weeds, grass ahead.

Treatment:

Keep injured part elevated, keep quiet.
Send for a physician.
Apply tourniquet immediately above bite.
Make cross-cut incision over each fang mark.
Induce free moderate bleeding.
Apply suction, suction cup or by mouth.
Never use an intoxicant.

TICK-SPIDER BITES:

Frequently search yourself and clothing and remove any ticks found.
If tick is fastened, cut out immediate area with sterilized sharp razor or knife.
Apply one coating iodine. If irritating tick or spider bite, apply cool, moistened, baking soda compress using sterilized gauze and water. If infected, go to physician.

SPRAINS:

Elevate injured limb.

Apply cold or hot applications.

If severe, give complete rest, see physician.

If shock present, use hot applications and treat also for shock.

Apply bandage applicable.

BREAKS:

Carefully move patient to comfortable position only.

Get a physician and instructions if possible.

If absolutely necessary to transport, splint broken leg or arm first.

Usually necessary to treat for shock.

THE RANGER ALTERNATE

The ranger alternate's job in fire control is very similar to that of the ranger since, as in other district work, he must be prepared to take the ranger's place at any time. He must be able to:

Gain the respect and support of the district employees.

Assume charge of all fire control operations.

Instruct and train temporary employees in their duties.

Inspect work of employees and correct errors.

Do any field job required in fire control work on the district.

Make suggestions for improving fire control plans and practices.

He must study and become an authority on:

1. Forest Service fire control policies.

2. That portion of the District Fire Control Plan including:

a. Fuel type maps and overlays.

b. Transportation system maps.

c. Index maps.

d. Detection responsibility maps.

e. Detection coverages.

- f. Patrol coverages and scheduled trips.
- g. Smokechaser responsibility maps.
- h. Smokechaser travel time coverages.
- i. Man-power placement maps and tracings.
- j. Communication maps and tracings.
- k. Organization and improvement summarization tables.
- l. Instructions to each man in the organization.
- 3. Those portions of Part I of the Handbook that pertain to his job.
- 4. Fire Dispatcher Action Record.
- 5. Azimuth circle and parallel rule functions.
- 6. Fire map showing fires by classes.
- 7. Forest Service procedure in regard to:
 - (a) Allotments
 - (b) Expenditures
 - (c) Records and reports
- 8. Fire Danger Chart and the Forest Fire Danger Meter.
- 9. Methods and requirements of taking fire danger measurements.

Duties:

The district ranger will furnish the alternate a written work schedule covering the specific lines of work, jobs and trips assigned to him.

His principal fire control duties include:

- Instructions and training of fire control employees both in training camps and on the job.
- Inspection of fire control stations, crews, fire packs, caches, and fire action of any nature.
- Report on the form provided complete findings and action taken by him on all inspections.
- Taking corrective action wherever needed.
- Seeing that permittees comply with fire control requirements.
- Instructions and assistance to cooperators.

In the absence of the district ranger it is his duty to:

Assume charge of the district organization.

Keep the men in the fire organization alert and ready.

Work with the dispatcher in getting correct, speedy fire action.

Handle all reports and district work as scheduled.

Keep close daily contact with all district personnel.

Promptly advise the ranger or, in the ranger's absence, the Supervisor of any important developments.

Take field charge of any fire that gets beyond control of first-line forces, unless relieved by the ranger or Supervisor.

When large fires occur the alternate must act quickly on his own responsibility.

If he cannot get in touch with the ranger or the Supervisor, he should lose no time in taking the following action:

Completely calculate the probabilities (Fire Dispatcher Action Record).

Dispatch men, supplies and equipment commensurate with the job.

Provide transportation, and where necessary lunches, meals and lodging for men while en route to the fire.

Decide on special equipment, and order if needed.

Have the fire scouted before arrival of crew.

See that fully adequate overhead is provided. There shall be no hesitancy in going to the Supervisor for overhead if the district cannot supply it.

Provide guides for crews en route to fires.

See that all routes are plainly marked at intersections of roads and trails.

Provide necessary communication.

Provide for necessary follow-up action.

Take charge of and direct fire line action.

(See "Fire Boss Tickler List" fire suppression chapter of this Handbook for further details.)

Responsibility:

The alternate is responsible for action taken by him in the same degree that the ranger is.

He is accountable to the ranger for:

Compliance with outstanding instructions.

Adherence to his schedule of work.

Promptly reporting failure or weakness in the organization.

Taking necessary corrective measures.

All actions taken by him.

Complete cooperation between ranger and alternate can be brought about by:

Current written instructions by the ranger.

Frank discussion of plans, jobs and methods as questions arise.

Interchange of copies of inspection records.

Current memorandums and reports.

Trip plans for the alternate coordinated with the ranger's.

DISPATCHER (RANGER DISTRICT)

The dispatcher is the ranger's assistant at the headquarters station, and has certain administrative and fire control duties to perform.

The dispatcher must be:

Mentally alert and able to decide and act quickly and surely.

Willing to work long hours, day or night when fires occur.

Physically able to do hard manual labor.

Able to do clerical work, keep records, charts and make reports.

Qualified for lookout and fireman's positions.

Generally familiar with improvement work.

Familiar with the district in which he works, (the more detailed his knowledge the better).

Thoroughly informed on the communication and transportation systems and problems affecting travel to fires.

Always courteous to Forest users and visitors, as well as pleasant in dealing with employees of all classes.

Thoroughly acquainted with the district fire plan and facilities for dispatching to fires.

Duties:

While the dispatcher is expected to do administrative work, his principal job is fire control.

Keep:

Food supplies stocked to quantity required.
Orders from field promptly filled.
Current want list from various stations.
Stock on hand invoiced and arranged in orderly fashion.
Equipment repaired and stored in the place selected.
List of equipment needs available for ranger.
Fire cache and packs ready for immediate use.
Fire control trucks and cars ready at all times.
Useless equipment segregated for condemning.
Ranger and alternate informed on everything requiring their decision or action.

Records and Reports:

Dispatcher's daily log or diary.
Data on "Dispatcher Action Record."
Data on "Current Fire Record" (if used).
Fires, by classes on district fire maps.
Accurate fire labor costs and man-power by days.
Meal records.
Monthly district payroll to Supervisor.
Occupied stations data by periods.
Currently, occurrence and status of fires to Supervisor.
Supervisor's number for reportable fires.
Fire data to Supervisor on Form 929 reports.
Daily fire weather data as called for.
Current revision of organization map of his and adjoining districts.

Additional information required by ranger.

Dispatching duties consist of:

Receiving and recording all reports on fires.
Checking to obtain any additional possible lookout readings.
Determining correct location of fire on map.
Informing ranger or alternate as soon as practicable.
Assigning men to go to fires as directed or as circumstances dictate.
Checking information with men before starting them to fires.
Correct Form 17 R-1 data.
Best route to fire.
Accurate location on fireman's map.
Correct compass backsight nearest visible lookout.
Calculating probabilities of spread and man-power needs on going fires in the absence of the ranger and alternate or when directed to do so by either of them.
Preparing necessary "Fire Dispatcher Action Record."
Initiating necessary follow-up action.
Keeping informed on any going fire.
Currently advising Supervisor of conditions.
Taking immediate steps to re-man points vacated by men sent to fires.
Checking reserve forces and equipment that might be needed.
Recording all important facts and action taken.
Training lookouts over telephone by giving them problem fires, checking orientation and accuracy of reporting, map reading, etc.

General duties consist of:

Receiving and making communication test calls.
Sending or receiving radio messages.
Keeping informed as to Forest users.
Cheerfully dispensing information to inquirers.
Keeping informed on district activities.
Informing all stations as to time and fire weather.
Attending to any other clerical duties assigned by ranger.

Keeping headquarters office and yards clean and neat.
Recording fire danger measurements, weather forecasts, and rainfall data.
Maintaining property records.

FIRE CONTROL DISPATCHING

One of the most important jobs in fire control is that of dispatching. After a fire is discovered and reported the dispatcher is responsible for accurately ascertaining its location, calculating its probable spread, computing the man-power needs for first period control, and dispatching men, equipment and supplies in balanced numbers and quantities to insure control within the time objective established (in no case beyond 10 a.m. of the day following discovery). Each case is a little different from every other, therefore, the dispatcher must secure all pertinent information from every possible source. Recognizing the necessity of using a judgment factor in adjusting action to fit each individual fire, there are still certain principles which apply in all cases. Likewise there are certain time standards to be met and records to be kept which are uniform.

Form R1-Fl2, Dispatcher Action Record - Part One:

This form is provided as a dispatcher's "Tickler List" and for use as a means of recording, in rough scratch form, the history of action taken upon each and every fire that occurs. It also provides ample space for rough notes and calculation of probabilities. Its use (together with part two when reinforcements are needed) is intended to eliminate the need for any other fire dispatching form or record of dispatching actions. The extent to which the various parts of the form is filled out in individual cases will be governed by the needs in each case. Therefore, it becomes a responsibility of the dispatcher to determine when sufficient information has been recorded, and when adequate calculations have been made to serve as the basis for dispatching.

DISPATCHING TECHNIQUE

Page One of Form R1-F12

This provides space for recording information, in any required amount, as furnished by the discovering agency or by other observing agents, if more than one.

Page Two

This provides space for recording the initial first line action taken. Following this record is a general tickler list and space for recording probabilities and man-power needs based on further study of fuels, weather, and the behavior of the fire.

Dispatchers will be furnished with "Calculation of Probability Guide Charts" upon which will appear more detailed instructions on this phase of their job.

Page Three

This page provides space for recording the follow-up action taken based upon preceding calculations. It also provides space for a recapitulation of the job size, if such is deemed necessary.

Form R1-F12a, - Dispatcher Action Record, Part 2.

This is a tickler list, record of calculation of probabilities and action taken on fires requiring heavy reinforcements.

While the principles of calculating spread and man-power needs are the same as for small fires, it involves such a large area of varying fuels, and other factors effecting spread and needs for men and equipment that the ablest men on the Forest or even in the Region must be called to the task. So many variables are involved that no complete guide can be furnished, but special weight should be given to (1) history of the behavior of the fire (2) danger rating of the season as a whole and probability of catastrophic fires (3) difficulties and lost time in placing men advantageously (4) likelihood of spot fires and difficulty of holding line (5) reasonable output to expect under all existing conditions.

General:

Each part of Form R1-F12 contains extra scratch paper upon which all necessary

calculations should be made. Also, rough notes of pertinent data should be reached thereon. In this manner a complete and comprehensive history of action will have been preserved intact for each fire from which the 929 report and analysis of action can be made.

A copy of, or the original Dispatcher Action Record Form R1-Fl2, will accompany Form 929 fire report to the Supervisor's Office.

LOOKOUT - FIREMAN

The positions of lookout and fireman are usually combined in one man called lookout-fireman.

The instances where a man is hired solely for lookout work or fireman's work are very few. Since there are some such cases brought about by special needs for smokechaser coverage or detection coverage, the specifications and instructions for lookouts and fireman are kept separate.

The lookout-fireman is responsible for compliance with both sets of instructions.

THE LOOKOUT

Detection of fires is one of the most vital features of fire control. The lookout man is a key man in the fire control organization. As such he must be continuously on the job. No leaves of absence are granted.

Quick control of fires and elimination of dangerous hangover fires require prompt detection, accurate location and intelligent reports promptly made to dispatchers and in any case follow-up reports on progress of fires.

The lookout man must have:

Good eyesight, strong and healthy physique.

Sufficient education and intelligence to make accurate reports.

Alertness and be willing to work long, tedious hours.

Thorough knowledge of his territory.

Training in the details of his job.

To handle his job successfully he must be on the job and know:

Principles and use of the compass.

Use of the alidade and azimuth circle.

How to orient a mapboard or firefinder.

Map reading in all details.

Identification of physical features with map.

Weather measurements, reporting and use.

Lightning storm action, how reported.

Location of lakes, mountains, creeks, ridges, ranches, roads and trails within his range of vision.

What a small fire looks like.

Difference in appearance between smoke and fog.

Gauging the progress of a fire by the smoke column.

All details of fireman's job.

Communication and transportation systems of his area.

Equipment:

Each lookout shall be equipped with:

1. One of the four kinds of firefinders,
 - (a) Koch type which includes one baseboard, one mapboard, district map with azimuth circle and 18 inch alidade.
 - (b) Weholt type which includes baseboard, mapboard, district map, xylonite azimuth circle and alidade attached.
 - (c) Bosworth firefinder with map and azimuth circle.
 - (d) Osborne firefinder with map and azimuth circle.
2. Complete fireman's pack.
3. A complete set of record forms which consists of:
 - (a) Lookout Fire Report Form 17 R-1.
 - (b) Diary book.
 - (c) Lightning storm report (if station is selected as an observation point.)
 - (d) Lightning strike record.

(e) Fireman's Report, Form 592.

(f) Necessary rain or wind gauge forms.

The equipment must be checked against this list for completeness. A tag listing the contents of the fireman's pack is attached to the pack. It must be used as a check of the completeness of the pack.

Preparedness:

Advance preparation for fires is necessary. Fires often occur in groups over a period of a day or more. The lookout man must be prepared for long and continuous duty on the lookout or in going to fires.

Other men may be sent to work from his station to assist in covering all of the fires. On such occasions there is little time to do chores.

Everything must be in readiness for such emergencies:

Lookout windows clean and view unobstructed.

Map board base solidly set and working parts oiled.

Map clean and kept oriented, checked daily and before each reading, or series of readings.

Alidade sights with hair or wire always provided and in alignment - extra hair or wire on hand.

Fire finder clear of obstruction - not used for table or shelf.

Report forms and pencil readily at hand.

Telephone in working condition.

Test calls as directed by the ranger.

Mapboard light working - batteries strong.

Other lights - cleaned - filled - ready.

Fireman's pack complete and ready.

Tools in proper condition for use.

Hand pumps if required oiled and near packs or attached.

Twenty-four hour water supply on hand.

Two weeks' wood supply - stove size.

Adequate food supplies on hand.

Car as specified in "General Instructions."

Saddle horses saddled and ready to go throughout day time, (if horse is required).

Lightning Storms:

The following points should be observed when lightning storms occur:

Report thunderheads to the ranger when they appear.

Give location and direction the storm is travelling.

Pass the word on to other lookouts and dispatchers.

Have mapboard orientation checked and ready.

Be on lookout all during the storm - day and night - do not let meals interfere.

Watch continually for "hot" strikes.

Keep a record of the location of all strikes toward ground - use form provided.

Mark the locations on a map.

Telephone the information ranger headquarters immediately.

Check off all strikes on the record which develop into fires.

Watch the location of all strikes intensively during the succeeding days.

Recording Lightning Strikes:

Mount a strip of thin white cardboard over map and under the metal azimuth rim and allow to extend 1-1/4 inches inside of the azimuth rim. Pencil lines in direction of lightning strikes with time and distances, will be recorded on this strip.

Upon appearance of a lightning storm, see that fire finder is ready.

Have clock in position for reading from finder.

Face storm across fire finder and point sights in direction of storm.

Have pencil in writing hand ready for action.

When a strike appears quickly line up sight, draw line on cardboard strip toward the strike along line of sight, and record time to nearest half minute.

When storm has ended ascertain azimuth, time of each strike and location of each strike and report to dispatcher.

Thunder is simultaneous with the lightning at the location of the strike, and sound travels one mile in approximately five seconds. If a clock or watch can not be read directly for number of seconds between strike and sound of thunder, the period may be

determined by counting from time of strike until the thunder is heard. By beginning the count, thir-teen, four-teen, fif-teen, etc. and by practicing and checking with the clock, satisfactory accuracy is attained. Assuming the count started at thir-teen when the lightning flash was seen, and ended at forty-two when the thunder was heard, subtract twelve from forty-two which leaves thirty, or number of seconds. Divide thirty by five and you have six or the approximate number of miles from the observer to location of strike. Scale off six miles in direction of strike and you have approximate location of strike.

The method for determining distance from observer along a line of sight to the strike permits any single lookout or the dispatcher to locate a strike by use of an azimuth and scale. This method is also a very good check against the use of two or more azimuth readings and the intersection method.

Generally, location of lightning strikes are calculated by the dispatcher who uses two or more azimuth readings from different observers on the same strike. These readings are platted on a map and the location of the strike is determined to be at the intersection of these lines. The correct location will be reported back to the lookouts concerned.

Detection

Detailed written instructions and schedule of work applicable to each station will be furnished by the district ranger.

Detection work must be:

- Systematic in procedure.
- Accurate in each detail.
- Unfailing in regularity.

Minimum Requirements are:

1. A systematic, complete, intensive observation of the visible area consuming at least 20 minutes of each daylight hour. The ranger or alternate will require observations when he considers it necessary.
2. Observations must start at a given point and follow around clockwise to the starting point systematically viewing each ridge and canyon as it falls within the range of vision.

- 3. Scheduled night observations under detailed instructions by the district ranger.
- 4. Means for orienting the fire finder at night. Distinct marks, coinciding with daytime orientation points, shall be placed on the walls inside the cabin.
- 5. Recorded bearings, location and description of all beacons, trash burners and other recurring smoke or lights.
- 6. A posted record of visible "false smokes" including all objects which may be mistaken for smoke, showing the section, township and range, azimuth reading and brief description.

"False Smokes" may include:

- Distant rock slides.
- Alder thickets.
- Saw mill smokes, railroads, etc.
- Fern patches.
- Bodies of dead timber.
- Dust - sheep, roads, etc.

- 7. That the lookouts have the qualifications upon which successful detection is dependent including:

- Integrity - being on the job.
- Skill in the use of all detection equipment.
- Thorough knowledge of areas for which he has responsibility.
- Ability to distinguish between real and false smokes.
- Carefulness.
- Speed consistent with accuracy.

Reporting Fires:

- Accurate fire locations are necessary.
- Complete information as indicated on left margin of the "Lookout Fire Report."
- All of it is essential in dispatching.
- The information supplied by "Lookout Fire Report" shall give the dispatcher a true picture so far as possible of the fire as seen directly or indirectly from the lookout station.

Fire reports by lookouts must be:

Accurate.

Thoroughly checked.

Promptly communicated to dispatcher.

Supplemented by adequate additional notes of fire behavior as seen from the lookout, from discovery to time last smoke is seen.

The following order will be observed:

Notify dispatcher that a fire is seen.

Recheck map orientation.

Get azimuth reading.

Identify topography progressively from lookout to the fire.

Locate and spot fire on the map.

Check azimuth and location.

Fill in the Lookout Fire Report.

Telephone the information to the dispatcher.

Going to Fires:

The lookout man is also a fireman, and it is his duty to go to fires when sent. (See Fireman's Instructions.)

General:

The lookout man must be familiar with and governed by:

The general instructions in this Handbook.

Special written instructions of the ranger.

The specific instructions in this Handbook, which apply to his position.

Inspection:

The lookout man shall be furnished with the inspection outline used by Forest and Regional Office inspectors.

He will use this outline as a guide to inspect himself so that nothing will be missed in keeping his accomplishments to the desired standard.

The ranger may and is encouraged to require each employee to make thorough periodic self inspections, and to fill out the inspection report form to be checked by the ranger or his alternate at the next visit made for the purpose of inspection and training.

In every case the inspector will furnish a copy of his report to the man inspected, and will freely discuss both satisfactory and unsatisfactory items. Needed corrections will be made at the time.

Orientation

The printed material on the lookout map is a reproduction of the area surrounding the lookout point drawn to scale so that all distances and positions are in proportion to and arranged the same as those on the ground.

To orient the map means to place it so that it sets square with the world the north end facing north, the east side facing east and so on. It will then lie exactly as the country that it represents.

Orienting Koch Fire Finder

In orienting, first see that the mapboard is level and have the north end approximately north.

Place left edge of the alidade against the pin indicating your position on the map with the same edge passing directly over an accurately located peak. Move the board on the base until the line of sight, through the alidade, passes through that point on the ground. Clamp the straight-edge snug against the edge of the mapboard. The board is now in orientation as to that one peak, but should be checked by swinging the alidade until the left edge passes directly over another selected peak and sighting to see if that peak is intersected by the line of sight. The orientation must be checked on at least two peaks, and the differences, if any, compensated by splitting the amounts of error.

The principle of orienting maps with all fire finders is the same. The Bosworth and Osborne map bases and sights may be moved independently and each clamped when necessary by means of set screws.

The ranger will designate at least three peaks at each lookout which have proven reliable for orienting the mapboard. The names and bearings of these established points must be posted in each lookout and must always be used in orienting the mapboard. He will also require that a nearby orientation point be established, signboarded or marked, and map or margin on fire finder designated so that the orientation point can be easily identified during haze and fog, or at night.

Fire Finders

The fire finder is the instrument which the lookout uses to locate fires which are discovered from his station. Four kinds are in use.

Koch Finder

The Koch fire finder has a base board supported by a post or tripod. The mapboard, sets on the base board which is fitted with a straight edge against which the edge of the mapboard is placed. The straight edge is loosened at one end by a set screw and moved when orienting the mapboard. The map has an azimuth circle drawn on it and an 18 inch common alidade is used to take readings on fires.

Weholt Finder

The Weholt is similar to the Koch finder except that the alidade is pivoted in the center of an azimuth circle on an xylonite cover and the cover adjusted over the map so that the center of the azimuth circle is directly over the lookout point.

Bosworth Finder

The Bosworth finder is all metal. The map is mounted on a round metal base and has the azimuth circle on a brass rim around the outer edge. The lookout point is the exact center of the azimuth circle.

Sights extending above the base at the rim are supported by an arm that rotates freely around the metal pedestal supporting the map base. They are connected across and above the map by a fine wire which intersects the lookout point in the center on the line of sight.

The pedestal is set on a sliding base so that the whole map may be moved to avoid obstructions to sight. The map base rotates on the pedestal for orientation purposes and is clamped in any position with a set screw.

Osborne Finder

The Osborne finder consists of a wooden base board fitted with steel tracks upon which the metal map base sets and may be slid to one end or the other to avoid obstructions to sight.

The map base of metal is round and the sights are set in a metal rim around the outer edge with the rear sight at zero of the azimuth circle. The metal rim is the

azimuth circle, graduated in degrees and half degrees, and rotates around the map base. Readings are taken when graduations on the azimuth circle are in alignment with a vernier set in the base at the south side of the board.

The map is always mounted so that due south falls at zero on the vernier.

The sights are connected across and above the map by a light steel tap set on edge which intersects the lookout point in the center of the board. The tap is graduated in miles for determining distances on a half-inch map.

The rear sight has a sliding peep and the front sight two cross hairs for taking vertical readings. The rear sight is graduated in degrees for obtaining vertical readings. Instructions for taking vertical readings are stamped in the metal of the rear sight. The peep intersecting the upper cross hair gives a plus reading, the lower a minus. The vertical reading is not required except in special cases, which will be covered by detailed instructions from the ranger.

The Alidade

The alidade is a ruler, with sights attached at the ends, used to sight various objects usually fires. In sighting, either for readings on the azimuth circle or in orienting the mapboard, the left side of the ruler represents the line of sight and is placed against a pin inserted in the map at the exact point where the lookout is located. Using the left side prevents any of the degree numbers on the left being covered up. The sights on the Bosworth and Osborne fire finders are not primarily alidades and will be referred to as sights.

The 18 inch alidade is used with the Koch fire finder. The alidade used on the Weholt finder is pivoted in the center of an azimuth circle on a xylonite cover which is placed on the map with the azimuth circle centered at the lookout point. The left side of the forward end of the alidade is cut out so that it coincides with the line of sight.

The rear sight on alidades and lookout boards have a lengthwise slot to look through, while the front sight is open with a hair, wire or thread stretched vertically through the center. Whatever material is used it is called the hair. The hair in the front sight must always be taut and straight.

Azimuth circle

The azimuth circle as used on lookout maps is a complete circle of 360 degrees, usually graduated in degrees and half degrees. Every 10th degree is numbered, the numbers proceeding clockwise around the circle.

The circle is drawn or placed on the map with its center exactly at the lookout point and graduated so that a north and south line through the lookout point passes through the zero and 180° marks, the east line intersects 90° and the west line falls across 270°.

In sighting a fire, after orienting the map, the alidade or sights are adjusted until the hair splits the location of the fire. Then by reading the degree number where the left side of the alidade (or the wire or tape connecting the sights) intersects the azimuth circle on the edge toward the fire, the bearing or azimuth reading of the fire is obtained.

The azimuth circle on the Forest Service smokechaser compass is graduated to 360° but is numbered from zero or north, counter-clockwise. This arrangement facilitates obtaining readings that coincide with those taken at the fire finder, and will not be confusing after one has been trained in its use.

Patrols from lookouts

Patrols on foot, horseback, or by car are necessary from many lookout points to cover areas not otherwise seen. The district ranger shall issue written instructions and a schedule designating the frequency of patrol trips, the regular or special equipment to be carried, the time consumed on each trip, and places and length of observations.

The minimum requirements are:

Patrol routes from each point to be numbered.

A sign posted at the take-off, with the name of the lookout point and number of the patrol, indicating the direction to take.

Patrol route plainly marked to observation point or points with blazes, tags, or other adequate marks.

Provision at observation points of lookout trees, L-6 lookout towers or other structures to raise the observer above brush, trees, etc.

Scheduled telephone reports to designated station while away from regular station.

THE FIREMAN

The fireman must be:

Able bodied with good eyesight.
Willing to stand hardships and hard work.
Qualified to do lookout work.
Able to take care of himself in the woods.
Acquainted with his territory and its topography in detail.
Trained in the details of his job.

He must know how to:

Read a map in detail.
Use the compass and map skillfully and find his way through the woods with them.
Use all communication facilities, instruments and devices available for his use.
Use axe, grub-hoe, shovel, and other equipment with skill.
Care for his tools and equipment.
Do trail and telephone line repairs.
Do his own cooking.
Size up a fire and plan where and how to attack it.
Fight fire under various conditions.
Distinguish between mineral soil and duff.
Make a fire line safe.
Mop up inside the fire line.
Determine unfailingly whether a fire is dead out.
Cool down and stop spread of a hot fire by:

- (a) Use of dirt in an effective way.
- (b) Use of water where that is faster than dirt.
- (c) Building the right kind of fire line.
- (d) Preventing fire from spotting or crowning.

Searching for fires:

Adequate knowledge of territory and complete description of the fire location

reduce search time. When the vicinity of the fire is reached and the smoke is not seen:

Check again on location given you and topography indicated.

Look for your landmark, previously picked out.

Climb a tree and look for smoke. Get back sight if possible.

Find a point where back sight may be taken on the lookout point and get on the line of the azimuth reading.

Search area each way along this line from reported location of fire.

Systematically cross-section the area.

Smell out smoke by wind direction.

Cross to another ridge or slope and look back.

Do not mill around aimlessly in the area where the fire is supposed to be. There is little chance of finding the fire in this way. Take advantage of every opportunity afforded by topography to look around.

The fireman will be held responsible by the ranger for immediate attack of fires to which he has been sent and for use of the best suppression tactics and technique in controlling and putting out fires.

He will go to fires outside of his district whenever the ranger or alternate requires it. He must be ready to start to fires at all times, day or night. He will never delay start in order to cook or eat a meal after he has orders to go.

He must at all times keep:

Himself neat and appropriately dressed.

Twenty-four hours water supply on hand.

Two weeks wood supply - cut up - stove size.

Buildings and grounds in a neat and sanitary condition.

Fireman's pack complete and ready to go.

Horse up in daytime (hours specified by ranger).

Horse saddled when immediate need is likely.

Car ready as specified in "General Instructions."

Phone working. (Proved by regular scheduled test calls.)

Available to phone call day or night unless absence authorized.

Watch checked with headquarters - correct time.

"Lookout Fire Report" forms near phone.

Lightning Strikes:

The fireman, if not located at a lookout point, will:

Take compass bearings on nearby lightning strikes.

Obtain distance by the method described in lookout instructions under "Recording Lightning Strikes."

Report them to ranger headquarters.

Locate strikes on map.

Search for lightning strikes when so directed.

Receiving Reports:

The procedure in reporting fires and receiving reports should follow uniform practices so that error in relaying location and failure to get complete information is less likely to occur.

When a fire is reported to the fireman and he is instructed to go to it, he shall proceed as follows:

Take all information indicated on left margin of Form 17 R-1 "Lookout Fire Report." Mark location on his field map and decide the best route to take. **CHECK THIS IN DETAIL WITH DISPATCHER.**

Determine compass back sight on lookout, check with dispatcher and enter with other notes on location of the fire.

When the fireman discovers a fire his procedure shall be:

Fill out "Lookout Fire Report" as completely as possible.

Mark location and best route of travel on his map.

Telephone the information to ranger headquarters.

Ask for instructions.

If communication with ranger headquarters is impossible, call a neighboring station or, if no one can be reached by phone, leave a note telling location and when he left for fire.

If instructions as to preparedness have been followed, not over five minutes

should elapse from the time the fireman receives the report until he starts for the fire. Get-away time in excess of this must be explained to the ranger.

Travel to Fire:

To delay starting to a fire on account of darkness invites defeat of the purpose of corral before 10:00 a.m. of the following day.

It is important to:

Start immediately whether day or night.

Travel continuously at night as well as day.

(Exceptions to these rules shall be taken only upon the specific approval of the ranger in each instance.)

In going to a fire:

Fill canteen at start of trip and refill en route if possible to that canteen is full on arrival.

Take quickest route to the fire location.

Travel by road or trail is often quicker, though the distance is greater.

Make frequent observations en route, using lookout trees, open slopes or points.

Use back sight reading on lookout point to get on line when possible.

If the fire is seen at any time pick an easily identified landmark near it.

Mark take-off point on trail giving direction taken.

Running Compass Line to Fire

When you see the fire from a lookout point:

1. Open the compass and set it level on a stump or log with cover away from you.
2. Keep metals that attract the needle well away from the compass.
3. If the fire is higher, then you raise compass lid so sight from back of compass just passes over edge of lid. If the fire is lower than you, tip lid down so as to sight along white line.
4. Be sure the needle swings freely.
5. Turn the compass so that the white line on the cover points to the fire.
6. Let the needle settle and mark down the reading.
7. Pick out a foresight (some unmistakeable object on the line between yourself

and the fire which should not be lost from sight at any time while traveling to it).

8. Go to the foresight and set up the compass as before.

9. Turn the compass until the needle is fluctuating equally on each side of the azimuth reading.

10. Let the needle settle.

11. Turn the compass carefully to the exact azimuth reading which you marked down previously.

12. Sight along the white line on the cover and pick out another foresight.

13. Repeat the operation at each foresight until the fire is reached.

Getting on line

It is nearly always impossible to keep the lookout point in view when traveling to a fire. When the fireman reaches a point where the lookout point can be seen and wishes to get on line between the lookout point and the fire he proceeds as follows:

Face general direction of backsight.

Set the compass firm and level as described previously.

Turn compass so north end of needle rests on backsight reading.

When the needle has settled on backsight, sight through the compass sights.

Note on which side and the approximate distance the line of sight misses the lookout point.

If it misses to the left the observer must move to the right and vice versa.

Estimate the distance necessary, move over distance figured and set up the compass again. Repeat if necessary until the line of sight intersects the lookout point.

The observer is then on line between the lookout point and the fire and can turn the compass to the azimuth reading and proceed along the line toward the fire.

Extinguishing Small Fires

The fireman must be familiar with and make use of the most effective methods and technique of stopping fires and putting them out.

He must appreciate the necessity of stopping every fire as soon as possible and before 10 a.m. of the day following discovery. Many fires will be corralled long before that time. An explanation is required for each fire not corralled before 10 a.m. because

it then becomes an extra-period fire, will be exposed to the danger period of the day, and may for that reason become a conflagration.

Experience, training and good judgment are invaluable assets in fire fighting. The following suggestions will not replace them but will serve to refresh the memory of the man who knows something about the job. Disregard of one or more of the points listed have been responsible for many fires getting away.

Upon arrival:

Make note of the time.

Place fireman's pack in a safe place.

In sizing up the fire to determine points to attack, and methods to use, consider that:

Extreme heat is always dangerous and must be dealt with first. It may cause fires to crown, throw spots or spread fast.

Fire travels faster uphill than down.

If slope is steep fire brands may roll.

Wind generally blows up slopes in day time and down at night.

Wind fans a quiet fire into a dangerous one.

Fire is generally worst from 10 a.m. to 5 pm.

Ordinarily fires do not spread rapidly in duff.

Attack -- Corraling Fire

Cool hot spots with mineral soil. Use lots of dirt and reduce flames as first step. Look outside the main fire for spot fires. If any are found, cool them down and make them safe.

Rob fire of top fuels to stop spread, scatter ignited fuels well back inside and throw unignited fuels outside.

Cut off points of fire burning toward bad fuel.

Shovel and scrape edge of fire into burned area.

Cool down hot fires under low branching trees inside the fire with dirt, to prevent crowning.

Fell all burning snags or trees that have fire too high to put out without felling, being careful to prevent fire from spreading when they fall.

On steep slopes cut a deep trench, or bank up duff and debris below fire and cover

with mineral soil, to catch rolling embers.

Systematic well-directed action and steady pace are most effective. Over-exertion does not pay.

Mop-up -- Putting fire out

Trim off low tree branches, remove fuel from ground trees and snags.

Turn logs or chunks on slopes, so they cannot roll.

Scatter burning fuel near edge back into burn.

Separate burning logs and spread rotten wood, duff and embers.

Dig out underground fire. Don't bury it.

Cut and scrape fire from logs, chunks, stumps, snags, treetops, etc.

Throw mineral soil forcibly into burning cracks and weather checks. Use dirt in the same way as water to put fire out.

Mix burning fuels with mineral soil, turn over, dig up and stir repeatedly.

If water is used soak all sides of fuel, turn over, feel for live fire and drench again.

Buried stump roots may carry fire under trench to outside fuels. Dig them up.

Cautions:

White fluffy ashes indicate heat; feel them out.

Search nearby snags and tree tops for fire.

Look well outside fire line for spot fires.

Repeatedly look over, dig up and feel over burned area for smoke or hot spots.

Investigate stumps and roots for smoldering underground fire.

Feel around fire edge with bare fingers for hot spots.

See that there is an absolutely clean line cut to mineral soil around the entire edge of the fire and that nothing can roll across this line.

Before leaving spend sufficient time feeling and moving fuels to make absolutely sure the fire is out -- dead out.

Returning From Fire:

A complete report on Form 592, Fireman's Report, must be made out before leaving the fire.

A copy will be sent to the ranger at the first opportunity.

Complete notes will be required covering reasons for any delay or difficulty experienced in finding or suppressing the fire. These should describe the methods used to overcome the difficulty.

Mark route from fire to intersection with trail or road.

Report to headquarters from first telephone reached.

MEASURING AREAS INSTRUCTIONS

Everyone who extinguishes a fire must report the area of it. In order that areas of fires may be reported accurately, the following points should be kept in mind:

43,560 square feet = 1 acre.

10 square chains = 1 acre.

1 chain = 65 feet.

All land measurements or surveys are computed on a basis of horizontal or level distances. On slopes the difference between slope distance and horizontal distance varies with the steepness of the slope; the steeper the slope the greater the difference. Due allowance should, therefore, always be made for this difference when measuring up the area of a fire. A good way to check yourself on pacing steep slopes is to use a short stick of known length, five or six feet long, hold it in a horizontal position against your body and make a mark with the other end on the ground in front of you, then pace to this mark, measure again with the stick, standing on the first mark; repeat this operation up the hill.

The edge of a fire is generally very irregular and the shape is usually such as to discourage accurate measurement. However, small burned areas can be classified as circles, squares, or rectangles, and as such staked off to be measured.

Some burned areas will be outside the area staked off to be measured and some unburned areas inside, but in staking out the area try to balance these up as nearly as possible.

The circular method of measuring areas is the easiest to use, if it can be applied.

Having determined the boundary of a circle of the approximate area of fire, pace off the radius (distance from center to edge of circle). The following table gives radius lengths from small fires of sizes most frequently handled:

A circle with a radius of 37 feet covers $1/10$ acre.

A circle with a radius of 53 feet covers $2/10$ acre.

A circle with a radius of 59 feet covers $1/4$ acre.

A circle with a radius of 64 feet covers $3/10$ acre.

A circle with a radius of 83 feet covers $1/2$ acre.

If the burned area more closely resembles a square or rectangle, mark out a boundary for it, balancing unburned area within your line with burned area outside. When satisfied that the area within your lines is of approximately the same size as fire, pace off the length and width of the area. Measure these in chains and multiply. This will give you the area in square chains, and as there are ten square chains in one acre, you will get the area in acres by dividing by ten.

Main Points to Remember

Do not guess on area of fire. Measure it on the basis of a circle, rectangle or square.

If circle, measure radius (diameter from center to line) in feet and use table. Make note of length of radius if table does not give area for the radius obtained.

If square or rectangle, get the length and width in chains. Multiply these and divide by ten to get area in acres.

All fires less than $1/10$ acre should be reported in square feet.

The average man steps about $2\frac{1}{2}$ feet on level ground. Determine your length of pace on various slopes by actual measurement.

For squares and rectangles obtain length and width in chains. 1 chain = 66 feet.
Length (in chains) X width (in chains) + 10 = Area in acres.

THE PATROLMAN

Patrolmen are usually placed on account of special dangers, or to cover areas not

seen from any lookout. Men will be selected because of their qualifications for the particular job and will receive definite detailed instructions from the ranger. The ranger will also be responsible for training patrolmen on the job in the technique of meeting the public and educating them in care with fire, policing camp sites, etc.

Qualifications:

The patrolman must be:

- Physically able to do hard work and hiking.
- Clothed in guard's standard uniform.
- Possessed of a pleasing personality.
- Competent to keep essential reports and records.
- Courteous and friendly in contacts with public.
- Well informed and firm in enforcing fire laws and restrictions.
- Qualified for lookout and fireman's work.
- Trained in the details of the particular jobs assigned to him.
- Acquainted with the area adjacent to his route.

Preparedness:

The patrolman must have:

- His car in condition as specified in General Instructions.
- Fireman's pack complete and in car.
- A portable phone in car ready for quick hook-up.
- Phone tested daily.
- His watch checked with headquarters daily.
- Forms 17 R-1 for receiving reports and reporting fires.
- Suitable hiking shoes and other field clothing in car and ready for quick change.

Duties

The Patrolman must:

- Put up and take down fire posters according to ranger's plan.
- Replace soiled, unsightly and damaged posters.
- Contact local people and Forest visitors at every opportunity.
- Observe and enforce smoking restrictions.

Check on shovel, axe and bucket requirement.
 Obtain compliance with camp rules and restrictions.
 Keep a record of recreationists as specified by ranger.
 Warn campers of fire danger.
 Instruct campers and smokers in correct use of fire.
 Inspect and police improved camp grounds and other camp sites as directed by the ranger.
 Report unsatisfactory conditions at camps and the action taken.
 Make scheduled stops and fire observations and report by telephone according to prearranged schedule.
 Locate accurately with compass and map all fires observed outside his area.
 Make report on Form 17 R-1 and telephone it to headquarters.
 Report and extinguish fires within his area.
 Be ready to go to fires anywhere directed by ranger or dispatcher.
The patrolman shall be guided by the instructions under "The Fireman" pertaining to:

Lightning strikes	Travel to fire
Receiving reports	Searching for fire
Extinguishing fire	Returning from fires

General:

Patrolmen used under circumstances to which these instructions do not apply in whole must be guided by special written instructions from the ranger and should make use of such parts of these instructions and instructions for fireman as are applicable to his job.

TRUCK DRIVER

Quick action in getting men to fires often is dependent on the readiness of equipment and efficiency of the men who drive the trucks. Delays due to failure of battery or ignition, gas shortage, poor tires, etc. may cause disastrous results. They

are due to human failure and are inexcusable.

Every man (except CCC or ERA drivers) who drives a Government truck or car is required to have public liability insurance. The Supervisor or ranger will advise where and how to obtain it. Only in emergencies such as a going fire may this requirement be dispensed with.

Qualifications:

The truck driver must be:

- Able bodied and willing to work long hours in emergencies.
- Capable of keeping essential records and making intelligent reports.
- Of sufficient mechanical ability to make minor truck repairs and able to keep all parts of engine or truck working properly.
- A careful driver and courteous to the public.
- Able to make good time without speeding.
- Experienced or trained in the details of his job.
- Able to handle trucking efficiently over rough mountain roads.
- Familiar with all roads in the district, which can possibly be used by trucks.

Duties:

The truck driver shall:

- Truck equipment and supplies as district needs require.
- Protect supplies and equipment from rain, sun and dust in transit.
- Do any miscellaneous hauling required.
- Keep truck in working condition at all times.
- Keep gasoline tank filled, brakes adjusted, battery filled, and truck otherwise conditioned and equipped as specified in "General Instructions."
- Have tire pressure card posted in truck and tires inflated as specified.
- Service truck currently and keep up "Truck Service Reminder Card."
- Post "Instructions to Truck Drivers" Form 118-R-1 in truck, read and comply with the instructions thereon.
- Promptly replace worn, broken or lost parts, and report trouble which requires a skilled mechanic.
- Make minor repairs as needed.

Keep engine clean and wash truck frequently.
Fill out daily truck reports.
Keep a diary or daily record of orders and important occurrences.
Communicate frequently with ranger headquarters on all trips during fire season.
Provide truck with safe seats for hauling men.
Be prepared for immediate fire duty, day or night.
Get copies of waybills at time of loading and have them signed when load is delivered.

When going to fires he shall:

Before leaving get location of fire and place to unload.
Know or find out best route to take.
Make note of name of man in charge at fire.
Find out most essential equipment to go on first load.
Make best time possible without taking undue chances.
If possible, phone ranger or headquarters when load is delivered.
Lose no time in returning for second load.

THE IMPROVEMENT FOREMAN

Qualifications:

The improvement foreman must be able to:

Stand hardships and hard work.
Take care of himself and men under adverse conditions in the woods.
Use the compass skillfully.
Read a map in detail.
Find way through the forest with map and compass.
Set up camp in a convenient and workmanlike manner.
Organize and handle men on fire efficiently.
Instruct men in best methods of fire and improvement work.
Teach men to use tools properly.
Keep tools and equipment in A-1 shape.

Act as lookout or fireman when necessary.
Keep essential records accurately.
Make simple telephone repairs.
Understand and follow written instructions.
Keep a wholesome crew spirit.
Hold the respect of the men under him.

Organization:

The improvement foreman may have charge of a crew on trail, road, tower house construction, or other forest improvements.

Regardless of the size of his crew or assignment his responsibility for the action of his crew in being prepared for, going to, and suppressing forest fires is the same.

The crew will be trained as an overhead unit composed of firemen, foreman, cook, timekeeper, subforeman, strawboss, campboss, saw crews, etc., depending on the number of men in the crew.

Thus the crew may be used to overhead a crew of hired fire fighters, it may be used as a unit on small fires or men may be drawn from it for smokechasing and other specific fire jobs.

Early in the season the crew will be organized and trained in fire action, an organization plan made, and an outline of actions and specific instructions issued.

The foreman must be familiar with the plan and test his crew as to their ability to carry it out. He must also understand the different methods of fire fighting and be able to handle men efficiently both by the squad method and by assignment of a section of line to each man. (See fire suppression chapter of this Handbook.)

Preparedness:

Foreman and crew in whole or in part must be prepared to take quick action on fires anywhere they are directed to go by the ranger or dispatcher.

The foreman must have:

Communication working. (Proven by daily test.)

Some man or men in crew trained and designated as "Crew Firemen."

Fireman packs and crew packs complete, hung up under shelter and ready for use.

Tags on all packs showing contents and checked with contents of pack.
Fire equipment outfit, and plow or pump unit if so equipped, ready for quick get-away.

"Lookout Fire Report" blank Form 17 R-1 near telephone or radio, for receiving and reporting information on fires.

Drivers or driver instructed and familiar with their duties if trucks used.

Trucks in shape as required under "General Instructions."

Crew or part of crew held in camp during dangerous fire weather, when directed by ranger.

Shoes and other personal equipment of crew members in shape for cross country travel.

Provision, if practicable, for fire calls out on the job. Pre-arranged system for loading men and equipment.

Prepared lunch as boxed and ready to facilitate quick feeding en route or at the fire.

Lightning Storms:

Get in touch with ranger headquarters at once and act according to special instructions when a lightning storm is approaching.

See that all preparations for going to fires are complete.

Have all members of crew watch for strikes and smokes.

After the storm, if so directed by the ranger, patrol to pick up possible fires.

Going to Fires:

Before leaving for a fire:

Get all the information indicated on the margin of "Lookouts Fire Report Form 17 R-1, and check with dispatcher.

Determine method and best route of travel.

Ascertain from the ranger the part the crew will take in the organization on the fire.

Figure the backsight reading on lookout, record in note book and check with dispatcher.

When sending firemen to fire, see that they have complete information on the fire and route to travel and are completely equipped.

When going to fires:

Provide marked line from best point on trail for take-off across country to the fire.

Keep men together while traveling.

Men must carry back pack tools and equipment if not on road.

Use smokechaser tactics for searching out a fire. (See Instructions for Firemen.)

Fighting Fire:

On large fires the plan of action will have been mapped out by the fire boss, and the foreman instructed generally in writing as to his part of the job.

On smaller crew fires the foreman will be in charge of the fire unless relieved by the ranger or his alternate.

The following practices are important:

Make use of rules under instructions to firemen, under "Extinguishing Small Fires."

For larger fires see fire suppression chapter of this Handbook.

Use every opportunity to instruct men in fire fighting methods, use of tools, proper care with tools, etc.

Correct faulty or useless work at once.

Someone must stay with every fire until it is out -- dead out. See that a reliable man is assigned.

Report:

If a fireman is replaced by a foreman and his crew, he must fill out his part of the fireman's report and give it to the foreman, who is responsible for completing the report.

Forms 592 are in all fire packs and must be filled out before leaving the fire.

An accurate time record must be kept for all men and this accounted for as between fire fighting and the regular job on which the crew may be engaged.

Keep detailed notes covering any delays or difficulties experienced and reasons for any lost line or "blow-ups."

THE PACKER

The packer should understand and be chosen with the idea that he is an essential part of the fire control organization and that his responsibilities do not end with packing alone.

The packer must be:

- A man who understands and likes to handle stock.
- Physically fit and willing to work long irregular hours.
- Able to understand and follow all instructions.
- Capable of making accurate, essential packer's reports.
- Thorough and fast in corgoing packs and in loading stock.
- Qualified to do fireman's work.
- Eager and willing to go through to fire day or night.
- Willing to do other jobs assigned him.

Packer must know how and be expected to:

- Handle stock quietly and effectively.
- Use patience and nose bag of graip to catch stock.
- Never rope to catch stock, this spoils stock.
- Feed properly - economically.
- Gentle nervous animals by kindness.
- Give green or unruly stock sufficient work to keep them gentle.
- Wrangle stock at daylight and in hot weather have them on the trail in time to take full advantage of cool mornings.
- Prepare loads and cargo packs the night before.
- Weigh side packs, number and stack in individual loads.
- Estimate weight carefully when scales not available.
- Ask for waybill, have receiving person sign for goods received.
- Return receipt to headquarters.
- Pack anything transferable by pack animal.
- Protect packed materials from damage or losses.

Always take the mail.

Do own cooking when necessary and keep clean camp.

Make his own way over rough, untraveled routes.

Repair minor damage to trails and telephone lines.

Report to headquarters important damage seen in lines or trails.

Keep daily record of trips, loads, animals used, and other data called for by ranger.

Keep up daily diary, recording important data.

Special Care with Stock:

Keep shod up, reset shoes every six weeks.

Save and use serviceable used shoes. Don't use shoes worn out or sprung out of alignment.

Keep backs free from saddle sores.

Brush and/or curry backs before saddling.

Prevent wrinkles or lumps in blankets or pads.

Adjust saddle to animal. Avoid changes afterwards.

See that animal's number and name is on saddle.

Never tie lead rope to front animal's tail.

Use 1/4 inch tail ropes attached to saddle tree.

Use knots that untie easily in case of trouble.

Balance loads at start, check frequently, keep balanced.

Keep saddle blankets and pads properly adjusted on loaded animal.

Train stock to reasonably fast walk.

Refrain from trotting loaded animals, except in case of extreme emergency.

Water stock at every good opportunity while traveling.

Let cool off before watering at end of trip.

Inspect stock for injuries at end of each trip. Shoes, etc.

Doctor cuts, sprains and bruises immediately.

If sore back develops, find cause and remedy it.

Bathe tender backs with cool salt water solution.

Trim mules' manes and tails at least once each month.

Provide all new shoes on well trimmed feet each 30-40 days. Trim toes closely - leave heels as long or high as possible.

Never heat an animal quickly if it has been on dry feed.

Do not experiment with oiling animals - when you cannot diagnose the case or have no approved remedy available call the ranger for instructions. He will specify treatment or call a veterinarian. Many so-called home remedies are dangerous - avoid them.

A "packer's kit" is furnished which contains a description of symptoms and remedies for some of the more common ailments. Learn the use of these materials before an emergency occurs. Keep this kit with the pack outfit.

Make sick animals as comfortable as possible. Always keep head and back uphill if on sloping ground.

Maintain even normal temperatures by blanketing.

Provide hay, straw, boughs, blankets or some other for the animal to lie upon.

Never drench through nostrils.

Use mechanical rather than medicinal remedies where possible - usually a rectal injection of warm water is more effective than the best of chemical purgatives.

Packer's Kit - Contents

1 Hammer, farriers
1/2 lb. Nails, horse #5
1 Farriers knife
1 Rasp farriers
1 Pincers, hoof
1/2 lb. Rivets, copper asst.
1 Veterinary Kit

1 Handbook -- containing brief statement and description of symptoms and remedies for:

Colic	Cuts, bruises
Founder	Saddle sores
Kidney disorder	
Pneumonia	

Rules for feeding:

Use green feed whenever possible, even though it means increased wrangling time in, except in case of urgent fire needs.

Take stock to feed, do not turn out to make their own way. When hay and grain are fed, avoid waste, make and use rack for hay and nose bags for grain. Never feed grain on the ground.

Do not feed more than stock will clean up.
Feed rations as a rule should not exceed 25 pounds of hay and 8 pounds of oats per animal per day.

Frequent small feeds are preferable to longer feeding.

See that stock tied up over night have level ground to stand on, free of objects preventing lying down.

See that salt is provided regularly at rate of 3 pounds per animal per month, fed in boxes or salt troughs.

Do not water or feed oats to animals until they are cooled off at end of trip.
Water before feeding.

Do not picket an animal by head or neck. Use hobble strap attached to front foot and make certain animal does not tangle himself up. Use of conventional hobbles is preferable to picketing.

Care of equipment:

Keep rigging and halters repaired currently.

Replace worn rope, straps and other parts before they fail.

Stack saddles, blankets and pads in order on dry spot, if available, and cover with canvas.

Keep "half-breeds" properly padded with dried curled bear grass or hair.

Frequently clean blankets and pads of matted hair or caked dirt patches.

See that blankets are washed at least once each season.

Keep pack equipment and supplies protected from porcupine, bear and other predatory animals.

Fire Requirements:

Keep stock in good condition for fire call while doing a maximum of work.

Always report in to headquarters when passing a telephone on a trip during dangerous fire conditions as instructed by the ranger.

Be informed concerning Forest Fire laws and regulations, and observe them.

Have necessary axe, shovel and waterbucket.

Carry other fire equipment required.

Keep constant sharp lookout for fires.

Determine map location of fires seen.

Be a qualified fireman. (See fireman instructions.)

Put out small fires near route of travel.

Report to headquarters at first chance, any fires seen.

When packing to fires have the following information:

A map showing the location of fire camp, best route to travel and point to leave road or trail.

List of equipment most essential to pack first.

Name of men in charge of fire camp.

PER DIEM GUARDS

The best qualified men should be selected from communities within or adjacent to the Forest and appointed annually as Per Diem guards. They must be men who are interested in fire control work and willing to cooperate in the detection and suppression of fires within their own or adjacent neighborhood. It is also desired, so far as possible, they be available as smokechasers, strawbosses, or foremen, in case of real need at other points.

Due to the special nature of the job assigned a Per Diem guard, the ranger shall furnish him special written instructions or memorandum of agreement annually which will supplement the following general qualifications and statement of responsibilities.

Qualifications:

The Per Diem guard should be:

A leader in his community.

Experienced and trained in fire control work.

Thoroughly familiar with his territory.

Willing to work long hours on fire.

Ready to take action on fire, day or night.

Physically fit and capable of back packing across country day or night.

Able to use compass, and to read a map correctly.

Capable of recruiting and leading small fire crews.
Loyal to the principles of Forest fire control.
Informed in the district communication system and fire reporting procedure.
Prepared with necessary map, fire forms, general and special instructions with which he should become familiar.
Informed on Forest fire laws and regulations.

Responsibilities:

The Per Diem guard will be expected to:

Check up with ranger on action of each fire discovered by or reported to him.
Watch and report on action of lightning storm.
Make scheduled telephone test calls as outlined by ranger.
Go to and extinguish fires as directed by ranger.
In case ranger cannot be reached, take such fire action as seems necessary.
Be willing to adjust home work to meet fire needs.
Make necessary agreements with several dependable men who can assist on fire work as agreed upon with ranger.
Comply with instructions to firemen when going to and suppressing fires.
Make fireman's report Form 592 for each fire before leaving it.
Report to ranger promptly upon return from a fire, giving time for himself and men, etc.
Report promptly to ranger on fire law violations, giving evidence obtained by him.

Equipment

The Per Diem guard shall be:

Furnished with fireman pack of standard in use on Forest concerned.
Supplied with such crew equipment and rations as conditions require.
Responsible for keeping such equipment in readiness for fire use, except when a Forest officer is responsible.
Authorized and required to see that equipment is not used except for fire.

SUPPRESSION OF LARGE FIRES

In spite of speedy attack and application of best known methods, coupled with hard work and determination on the part of the first line forces, a few fires starting in worst fuels or in periods of extreme fire danger will spread to a size that will require organized crews of men to control them.

The successful handling of such fires constitutes the most difficult and exhausting job men are called upon to perform. The instructions contained in this chapter are designed as a guide and help in fixing responsibility, describing the various jobs to be done and the methods and tactics to be used. As in everything pertaining to fire action, experience, calmness, determination, and skill in the application of the instructions herein are essential to best results. The most that can be done here is to state principles and policies and describe methods representing the best that thought and experience through years of contending with large fires has taught us. The results will hinge largely on the resourcefulness and judgment with which men apply them on the job.

Of first importance is the determination of a corral time objective that will be the cheapest from the standpoint of the entire job, yet safe and sure, followed by prompt dispatching of sufficient man-power with everything needful to attain that objective. In every case the time objective will be before 10 a.m. unless it is impossible to reach the fire with sufficient resources to do the job before that time, in which case it will be the earliest practicable hour and before 10 a.m. the second day.

But it is of little use to do an accurate job of calculating probabilities of spread and rates of held line construction and man-power needs, followed by prompt dispatching and arrival at the fire of everything needful, if we then fail, through poor organization and handling of men or ineffective methods of fire fighting, to produce the held line reasonably to be expected. The approach toward increased production will be through training.

Foreman training constitutes the greatest single need at this time, with Forest officer overhead training ranking a close second. To meet this, a comprehensive and sustained training program will be undertaken covering the two main essentials -- handling men and methods of fire fighting.

DISTRICT RANGER

The district ranger is normally the responsible administrative head of the fire organization in his district, and all men in charge of fires within the district are responsible to him.

He shall:

Direct as fire boss the action on as many fires as possible.

Direct and coordinate action on several fires.

Delegate authority to alternate, dispatcher or others to release him for uninterrupted supervision on the fire line.

Provide for effective communication with fires or camps.

The following procedure will normally obtain:

All orders for overhead, men, transportation, equipment and supplies will be placed through his office.

All reports of progress will be made to and through him.

Policy, procedure, methods and personnel questions referred to him or his designated alternate.

FIRE BOSS

Any Forest officer in complete charge of a fire is directly responsible to the district ranger for the adequate handling of all work incidental to that fire until relieved of the responsibility by the district ranger or Forest Supervisor. He may be the district ranger, any qualified member of the forest personnel, or a detailed outside Forest officer. In any case his job is actively to direct operations on the fire line. He is in entire charge of the fire, and is responsible for the assignment of men to camps and sectors and instructing them as to the methods to be used.

On fires employing 25 men or less he may combine in himself the duties of fire boss, camp boss, fire scout, timekeeper, and foreman.

Before leaving for a fire the fire boss must obtain the following information:

Fire boundaries outlined on the best available map.
Weather data and latest forecasts.
Fuel type map covering the area if readily available.
Length of perimeter of fire.
Character of topography.
Forest cover and type.
Possible camp sites.
Kind of equipment needed and available.
Plans for man-power.
Plans for plows, pumps, tractors, etc.
Best route to fire and plans for marking route.
Names and qualifications of overhead.
Dispatcher's calculation or probabilities.
Plan for communication, including radio operators.
Latest lookout report on conditions.

He Shall:

See that transportation is available for men, supplies and equipment.
Make sure that such essentials as tools, equipment, and food supplies (including lunches) are given priority of transportation.
Provide rapid transportation for fire scouts to arrive ahead or among the first at the fire.
Dispatch scouts around fire immediately if not already scouted.
Instruct scouts as to information he needs.
If radios are to be used, get operators and instruments working on job.
Pick and instruct guides to lead crews; strawbosses to trail them.
See that no one smokes except at camps, habitations or within fire line during lunch or rest periods.
Arrange for saddle horse for his own use if such use is feasible.
Have foremen and strawbosses distributed in trucks with their men.

Hasten departure of men to fire in every way.

Arrive with camp boss ahead of crew.

Arriving at fire he shall:

Size up fire from best vantage points available and decide on strategy of attack.

Put men to work on line as soon as possible.

Formulate plan of action on fire.

Decide where camps are needed.

Instruct camp boss as to site and preparation.

Assign camp boss necessary camp detail of men and dispatch remainder to fire, tooled and lunched.

Camp in most strategic location regardless of water supply.

Provide for hauling or packing water if necessary.

Assign sectors to foreman and crews with complete instructions.

Distribute men as condition of fire warrants.

Have thorough search made for spot fires. Man them promptly.

Get report of essential facts to headquarters as soon as practicable.

From his own observations and reports of scouts, recalculate size of control job.

Order additional men and equipment if needed.

Rearrange fire crews as occasion requires and co-ordinate action.

When taking over a fire from a predecessor the fire boss shall:

Obtain a map showing the location of its perimeter.

Get information regarding the line constructed, mopped up, built but not mopped up, amount and location of unbuilt line and the danger spots.

Calculate the size of the job remaining.

Check co-ordination of camp and line organization.

Put into effect his best plan for completing the job.

Organization at fire

The place of the fire boss or sector boss is on the fire line directing the attack, improving the tactics and technique, and assuring himself that the planned-for progress is being accomplished. His organization should permit his spending 90% of his time

planning, coordinating and directing fire suppression work on the fire line.

He Shall:

Delegate as much authority to subordinates as practicable.

Obtain an assistant fire boss if size of job warrants.

Leave camp boss in charge of camp activities.

Inform timekeepers, tool sharpeners, packers, truck drivers, cooks and their helpers that they are under the direction of the camp boss.

Make it a rule to give subordinates definite written instructions.

Use messengers and do no errand running himself.

On very large fires assign sectors to sector bosses.

Assign at least 1-foreman and 2-strawbosses to each 25-man crew.

Take time to explain and demonstrate to foremen and strawbosses the plan of attack and the methods of handling men and of fire fighting which are to be used.

Instruct and assist sector bosses and foremen in distributing men around the fire.

See that foremen and strawbosses maintain the correct distribution given them.

Check methods and performance of subordinates frequently and correct errors and failures.

Assign agitators to camp detail in the morning. Have time slips and transportation ready and have them discharged after crews have left camp.

Prevent discharged agitators from conversing with crews and see that they are sent to town as soon as discharged.

Have foremen and strawbosses instruct their men on the line in the technique to be used.

Be constantly alert for opportunities and use power pumps, plows, tractors and other special equipment where distinctly advantageous over other methods.

Get sector bosses, foremen and camp boss together early each night. Discuss and decide on the following for the next day:

- | | | |
|----------------------------|-------------------------------------|-------------------------------|
| (1) Reassignment of crews. | (4) Lunching arrangements. | (7) Special mop-up crews. |
| (2) Equipment. | (5) Arrangement day shifts. | (8) Use of special equipment. |
| (3) Changes in tactics. | (6) Night crew assignments if used. | |

Have foremen arrange bedding down of their crews and know where to find each of their men at any time.
Know where to find each foreman at night.
Make foremen responsible for getting men out in the morning at time agreed upon.
Have foremen check their men out and in to timekeeper, inform him as to rate applying.
Work men not over 12 hours per day except in emergencies.
Provide for relief shifts if men are needed longer on line or mop-up work.
Reduce hours to ten per day on mop-up.
See that camp is kept clean and sanitary.
Keep posted on fire weather reports and make every possible use of them.
Keep a daily record of important messages and fire action.
Observe and enforce no smoking except at camps, habitations, and inside of fire line at lunch and quartering periods. Make this emphatic.
See that all injuries receive prompt and necessary attention.
Save his physical energy by using saddle horse when possible.
Reduce force consistent with safety when fire is controlled.
Sign or authorize camp boss to sign time slips.
Rate each man at the top of the time slip by use of alphabetical letter placed in space immediately above word "Forest." Use the following:
 A - Especially qualified. D - Below average.
 B - Above average. E - Very unsatisfactory.
 C - Satisfactory.
Obtain district ranger's advance approval of release of crews.
Have district ranger's advance approval before leaving fire.

FIRE SCOUT

The fire scout is used as an assistant to the fire boss in keeping him informed of the location, condition, progress and behavior of the fire. He must be a man familiar

with and experienced in fire work, a good woodsman and hiker, and preferably a Forest officer.

When and as instructed, he shall:

- Proceed to fire ahead of the crew, mark the route with suitable signs and follow the instructions of the ranger or fire boss in conducting his scouting operations.
- Determine and map the perimeter of the fire on a scale of not less than 4 inches to 1 mile, or on the base map indicated in his instructions.
- Locate and map spot fires ahead of control crews.
- Map character and cover of country ahead of fire.
- Select new camp sites ahead of operations.
- Guide crews to new camps to fire or to fresh points of attack.
- Keep daily progress map of entire fire.
- Make compass ties to section corner or other monuments to locate fire perimeter.
- Assist fire boss in most urgent and important details.
- Make map (scale 2" or 4" -- 1 mile) for camp use (with the aid of the fire boss) showing spread of fire and progress of control.
- Use messengers to send urgent messages to fire boss regarding his findings.
- Act as messenger for fire boss when necessary.
- Keep routes from fire line to camps marked.
- Keep fire boss informed as to progress of fire control or fire behavior.

CAMP BOSS

The camp boss is directly responsible to the fire boss, or, is stationed at the base of supply remote from the fire, to the district ranger or other designated officer. His duties are a combination of clerical and administrative work. He should as far as possible relieve the fire boss of all duties regarding camp set-up, orders for supplies, men and equipment, care of equipment, timekeeping, compensation for injury cases, communication and transportation.

His duties shall consist of:

Seeing to the details of transporting men, supplies and equipment.
Setting up camp according to the plan and location directed by the officer in charge.
Issuing necessary orders and instructions and supervising work of cooks, time-keepers, tool sharpeners, truck drivers, packers, and others placed under his supervision.
Ordering the men supplies and equipment as directed by the fire boss or other officer under whose direction he is working.

In the performance of these duties he shall:

Assist the fire boss while en route in the multiplicity of jobs connected with getting men and equipment speedily to the fire.
To establish as soon as possible communication with headquarters and if necessary with other camps or parts of the fire line.
Take charge of setting up fire camp.
Obtain men for camp detail, including messenger service, set them to work and supervise them.
See that serving tables are set up accordingly to T-shaped or L-shaped plan to provide for double line feeding. (See Fire Camp Cook Book.)
Have garbage holes dug and toilets constructed at least 100 feet from camp, road or trail and below water supply.
Have toilets and garbage pits sprinkled with lime daily.
Rope or fence off kitchen and office quarters.
Provide for community bonfire away from kitchen on cold nights.
Have canvas on hand for extra shelter in case of stormy weather.
Direct the cooks in setting up the kitchen.
See that kitchen is neat, orderly and convenient; supplies off the ground and protected from weather.
Inform cooks as to the meal times set by the fire boss and see that the schedule is met.

Have double lunches prepared and sacked as required.
See that cooks provide appetizing and sufficient lunches.
See that there is no undue waste of supplies from any cause.
Instruct cook in best use of Fire Camp Cook Book.
See that sufficient supply of cooking wood is maintained.
Check food supply orders and cut out items not on standard supply lists.
Replenish food supplies from standard lists - not with boxed unit rations.
See that soapy dishes are well rinsed by two dippings in hot water.
Check timekeeper's records for conformity to existing instructions.
See that bedding is carefully stored, checked out and accounted for on time slips.
Have men roll, mark, check in, and stack their beds each morning as they get up.
Provide for checking beds to men going to bed.
Keep headlights and caps locked up, charge them out and check them in.
Care for medicine kits and issue contents as needed.
Provide personal commissary for men and see that timekeeper issues and charges it.
See that Forms CA-1 and CA-2, complete with proper witness statements, are made up for all injuries.
Receive and post fire weather reports and forecasts and see that fire boss gets them promptly.
Keep daily record of important action noting hour, minute and date in each case.
Settle all time disputes at camp and approve time slips for all men released.
Inform ranger headquarters of number of men released and their destination.
Instruct and check timekeeper regarding daily record of perimeter, area and held line of fire and number of men working, and phone these data to ranger headquarters each evening.
Have tool sharpener keep extra saws, axes and other tools sharp and ready for the fire line.
See that tools are placed in racks labeled with number of crew and name of foreman.
Schedule trucks - see that they keep excess equipment hauled from camp on return trip.

Arrange for car and truck parking.

Keep supply of gas and oil for trucks at camp.

When pasture is used require packers to wrangle stock at daylight.

See that sufficient supply of dry feed is on hand (when used) and that it is not wasted.

Locate stable well away from camp.

Require pack trains to go out with full unit loads of essential supplies.

Have all water bags soaked ready for use.

See that all lights are ready for use.

Keep in touch with the fire boss regarding camp moving, tools, equipment, and supplies, stock to be maintained, and orders to be sent out.

Sit in on evening planning of next day's fire action.

Keep posted on man placements and progress on the fire.

TIMEKEEPER

A timekeeper will be assigned only to crews of 25 men or over on fires. In very large camps he may have one or more assistants.

The timekeeper acts as camp clerk and under the direction of the camp boss will assist in keeping the camp up to the standards required in instructions under "Camp Boss." The timekeeper will be held responsible for:

Complete daily time records of all men connected with the camp.

Having time slips signed by himself and the man and approved by a Forest officer when the man is through.

Accounting for all commissary consigned to his camp.

Issuing and charging beds and all property except fire tools.

Keeping the time of hired pack stock used from his camp.

Complete and correct "Compensation for Injury" reports on forms CA-1 and CA-2.

Gathering information from foremen and keeping a progress map and daily record showing perimeter, area and held line of fire, number of men working, etc. and

phoning these data each evening to ranger headquarters after check of fire boss.

The timekeeper shall:

Act as telephone operator and as messenger when necessary.

Obtain weather reports and forecasts and see that the fire boss gets them promptly.

Order food supplies needed by the cook after the camp boss has checked and approved the order.

See that commissary supply needs are called to the attention of the camp boss and ordered with his approval.

Check and record mileages of cars or trucks hired on mileage basis.

Record speedometer readings of hired trucks at beginning of fire work and keep a record of the mileage chargeable to the fire.

Start "Horse and Mule Time Slip" for each hired animal on the fire and record the time worked daily.

Keep commissary, medicines, and special equipment such as headlights under lock and key and charge out when issued.

Become familiar with Compensation for Injury procedure from instructions in timekeeper's kit.

See that CA-1 is filled out and signed by the injured man.

Obtain data for Form CA-2 and fill it out including signed witness statements and present it to a Forest officer for signature.

Obtain signed witness statements at first opportunity.

Each 25-man unit of tools and equipment has attached a timekeeper's kit in a canvas carrying case. This kit contains all of the supplies, forms and instructions necessary for keeping time. Disputes over questions of time which arise must be settled with the employee before he leaves camp.

To minimize these disputes:

Study the conditions of the contracts until thoroughly conversant with them.

See that a discharged employee is frankly informed of the reason for discharge.

Hold strictly to the terms of the contract.

Provide for checks on all entries and computations on time slips. (One time slip

in error when releasing a crew throws suspicion on all others.)
Get foreman's note of the hour when any change in position involving a different rate of pay is authorized.
Designate only the point of hire for return transportation unless transportation is desired to an intermediate point on the same route of travel.
Allow eight hours per day only for travel by train or auto.
Allow actual necessary foot travel time in addition to above.
A day is from midnight to midnight.
Turn a deaf ear to the individual who attempts to talk you into giving additional hours, travel time or other advantages.
Refer any matters not settled satisfactorily to the camp boss.

Timekeeping Procedure

Take up contract of each fire fighter entering camp.
Enter on a time slip Form F-2 R-1 name in full, address, place hired, contract number, rate per hour, travel time allowed and classification or position.
Date and sign contract and return to employee.
Enter on time slip daily hours worked by each man.
Use carbon paper and make duplicate of time slip exactly like original.
Establish station along the trail in the morning and check the hour each man leaves camp. (Avoid delay.)
Check the hour each man returns to camp in the same manner, or through the foreman.
Report to fire boss time reports by foreman, which need investigation.
Check men by name and contract number.
Check with foreman on stragglers and men left to watch fire.
Allow no overtime for men hired on a day or monthly basis.
Enter commissary charges on time slip daily.
Do not accept cash payment for commissary.
Charge beds and property (except fire tools) when issued.
When men quit or are released have fire boss or camp boss decide what travel time should be allowed.

If men quit or are discharged before completion of first period specified in contract no travel time is allowed to or from fire.
If men quit before released, travel and transportation from fire to point of hire is not allowed unless they have worked 20 days or more.
Travel time is not included in computing the number of days in these periods.
Complete time slip as shown on samples in timekeepers' kits, deduct commissary and property charges or cancel property charges if property has been returned.
Show in lower left hand corner point to which transportation is allowed. If none is due enter "none." Do not leave the space blank.
Enter location of paymaster in space provided.
Scratch two or the words quit, discharged, released, leaving proper one to indicate action.
Sign the time slip and have the employee sign it.
Have the camp boss or a Forest officer approve it and rate the employee.
Check overtime slip with man.
Settle all disputes at the time the time slip is issued.
If error is made in the time slip make a new correct one. Do not alter or erase.
Give the employee the original if the paymaster is other than the timekeeper.
Preserve the duplicate for the Supervisor's files.

Transferring men and receiving transfers

Complete time slips of transferred employee to the hour when employee leaves camp and sign it. Endorse time slip on the back as follows:
"Transferred to _____ (place or name of fire). Travel time contingent on completion of contract in new camp. This time slip must be turned in to the timekeeper at _____ (place or name of fire) and endorsed by him before payment for travel will be allowed."

Take up time slips of men received by transfer and make new time slips starting from the date of transfer.

Give employee both time slips when he leaves camp.

SECTOR BOSS

On very large fires a sector boss will be assigned to full charge of each sector requiring the establishment of a camp or camps.

He is responsible to the fire boss for action on his sector according to the plan and instructions given him. His duties on his sector are similar to those of the fire boss on the whole fire. He shall assist in the initial action and in getting men speedily to the fire. He must be familiar with the instructions for fire boss applying to camp set-up, organization of forces and fire technique.

He is, in fact, the fire boss for his sector and shall be guided by the instructions set up herein for fire boss.

FIRE FOREMAN

A foreman will usually have charge of a crew on a fire. He may be assigned to a large or small crew, a sector of the fire, special work such as snag felling or mop-up or any other definitely described part of the fire job. His work and responsibility will be clearly defined by the fire boss or sector boss.

The foreman shall:

Understand thoroughly the job the fire boss wants to have done and how to do it. Plan daily in advance and lay out the work for his crew.

See to it that the strawbosses understand what is to be done and the methods to be used.

Delegate authority to strawbosses as necessary.

Personally direct the work of the crew assigned to him.

See to it that efforts are not wasted on unnecessary work.

See that strawbosses do not tolerate "gab-fests" and loafing.

Keep men distributed along the line as instructed by the fire boss.

Observe and enforce the rule of no smoking, except in camp, or at lunch times and quartering periods within the fire line.

Teach men to use and care for tools properly and keep track of extra tools.

Have a list of his men and check with timekeeper to see that time has been correctly kept.

Make written note of any change of assignment of a man involving change in wage rate and advise the timekeeper.

Report to timekeeper regarding stragglers and men left to watch fire.

See that men have lunches and that water bucks keep them supplied with water.

Discharge misfits, loafers and agitators.

Report any discharged men to fire boss.

Have all tools taken to camp at night and placed in a rack marked with crew number and foreman's name.

See that dull tools are sharpened or replaced with sharp tools.

Report accidents and names of witnesses to the camp boss.

See that any injured men get immediate first aid and are properly cared for.

Know where each strawboss sleeps, and have strawbosses know where each of their men sleeps.

Be responsible for calling out men on time in the morning.

See that crew are breakfasted and are on the line at the hour set by the fire boss.

Have men roll their beds and stack them at marked spot when they get up in the mornings.

Pace off constructed fire line each shift and record in notebook.

Keep data in notebook to report to the fire boss on the day's accomplishments.

Sit in with other foremen and the camp boss at night when so requested, take part in planning, and make a note book record of the plan and instructions pertaining to his part of the work for the following day.

Be familiar with the best tactics and technique in fire fighting as shown in this Handbook and see that they are practiced on the line.

STRAWBOSS

A strawboss may be placed in charge of a small crew, portion of a crew, sector of line, mopping-up or any other definitely described part of a fire control operation. He is ordinarily under the direct supervision of a foreman. His duties shall be clearly defined by his immediate superior.

Subject to such definition he shall:

Understand exactly what the foreman wants to have done, and where and how it is to be done.

Personally direct the work of the men assigned to him.

See that no effort is wasted on unnecessary work.

See that men do a reasonable day's work.

Keep his men well equipped with proper tools.

Show men how to use and care for tools.

See that men return tools to designated place at end of shift.

See that men keep track of tools and account for lost tools.

Help get men out for breakfast.

See that men roll and stack their beds.

Know where his crew sleep at night.

Make suitable lunch and water arrangements.

Allow no "gab-fests" or bunching up of men.

See that his men check out and in with timekeeper.

Keep a list of his men and check their time.

Look after the safety of his men on the line.

Care for injured men and report injuries promptly to superior officers.

Report presence of agitators to superior officer.

Recommend dismissal of lazy or incompetent men.

Observe and enforce the rule of no smoking except in camps or places of habitation, and at lunching and quartering periods within the fire line.

Put stop to smoking while riding in trucks or cars in Forest.

PUMP MAN

The pump man is selected because of his experience, and ability to operate the type of power pump assigned to him. He is subject to the orders of the foreman or strawboss in charge of the pump and hose crew.

He shall:

- Keep the pump in condition to run whenever needed.
- Remain at the pump constantly when it is running.
- See that supply of gas, oil, and grease is sufficient at all times.
- Keep a record of the pump on form provided.
- Help to back-pack pump and hose from one setting to another.
- See that pump, hose and accessories are assembled and packed for return.
- Serve in any capacity needed on fire when not pumping.
- Follow specific instructions accompanying pumper.
- Observe instructions regarding pump operation shown later in this Handbook.

KINDS OF FIRES

Forest fires may be divided into surface fires, duff or ground fires, and crown fires.

Surface fires burn litter, grass, weeds, twigs, logs, limbs, brush and the top layer of loose leaves or needles.

Duff or ground fires burn the thick matted layer of humus underneath the surface fuels.

Crown fires burn the foliage of trees. They are of two types:

1. The running crown fire in which the fire travels rapidly from tree top to tree top.
 2. The slow-travelling crown fire which depends upon the volume of heat and flames from surface fires to carry it into the crown of individual trees or clumps.
- Surface, ground and crown fire conditions may occur on a single fire.

fires. In Region One duff or ground fires rarely occur except in conjunction with surface

CLASSES OF FIRES

Largely for statistical purposes fires are divided into three classes:

Class A. Fires covering 1/4 acre or less.

Class B. Fires covering more than 1/4 acre and less than 10 acres.

Class C. Fires of 10 acres and over.

PARTS OF A FIRE

The parts of a fire are defined as follows:

Head - The side on which it is spreading most rapidly. Usually the uphill side or the side toward which the wind is driving it.

Rear or Base - The side opposite the head. Usually the downhill side or the side from which the wind blows.

Flanks - The other two sides.

Spot Fires - Small isolated fires outside the main fire resulting from sparks or brands from the main fire.

Perimeter - The whole outer boundary or edge of a fire.

Fire Line - The line where the fire is held. It may be the fire edge which has been dug out and shovelled back, a section which has gone out, a line that has been watered out or a constructed fire line of any kind.

Sector - A definite portion of the perimeter assigned to one man as sector boss.

Leeward side - The side toward which the wind is driving the fire.

Windward side - The side from which the wind is coming.

Trench - Narrow strip from which duff and top soil have been removed exposing mineral soil.

FIRE INFLUENCES AND BEHAVIOR

There are certain changes in burning conditions which normally occur regularly during the 24 hours of the day.

Fires are almost invariably at their lowest ebb from 3 a.m. to 8 a.m.

They gradually pick up from 9 a.m. to 12 m.

From 12 m. to 6 p.m. they burn most fiercely.

At about 6 p.m. their intensity begins to decrease.

After 10 p.m. they seldom make much advance and the intensity is greatly reduced.

Frequently a large percentage of the fire goes out as night advances.

Phenomenal humidity conditions or local winds may completely upset this schedule. If the fire burns briskly before 10 a.m. this is indicative of an approaching bad fire day.

Normally changes are so regular that the time of day can be used to guide suppression tactics.

Slopes

Slopes of varying steepness have the same effect on the spread of fires as does wind of varying velocities.

The uphill rate of spread without wind may even be faster than it would be on level ground driven by a wind.

Fire creates a draft and dries out and superheats the material above it.

Steepness of slope is a constant factor day and night while wind usually occurs only for a short period of the day.

Fires should be stopped on the upper side before they gain headway.

The upper side is nearly always the head of the fire.

FIRE FIGHTING

Fire fighting is the acid test of the protection organization and men.

Success is contingent upon the degree of preparedness, leadership, and the speedy

application of the best known methods and technique of fire suppression.

The necessity for speed and organized effort must be kept in mind. Rapid mobilization and transportation of an adequate force of men, with proper equipment, and experienced overhead all based upon careful calculation of the probabilities is the first essential. Then a quick and vigorous attack directed at stopping spread on the entire perimeter of the fire must follow, and it is at this point where there is most need for improvement in the fire fighting effort in Region One.

The three first and most vital questions a fire boss has to decide are: time of attack; point of attack and method of attack.

Time of attack:

Attack will be made at the earliest practicable time, day or night, as soon as the fire has been sized up sufficiently to permit of effective work.

In determining this, consideration must be given to (1) the physical condition of the men; (2) topography, cover and fuels; and (3) a careful size-up of the entire job looking ahead to holding the line through the danger period of the first day.

If men have worked throughout the previous day and have hiked way into the night, it will pay to give them rest, sleep and food, then hit the fire at daylight.

In some of our worst fuels consisting of thick brush, down timber and snags on steep to precipitous slopes, night work is unprofitable, often entirely impracticable. Failure to attack as soon as crews arrive must, however, be justified by the circumstances in each case.

Where men are worked throughout the night to gain control, provision must be made for relief crews the next morning.

Point of Attack

Thorough scouting is necessary before deciding on the points and methods of attack.

Consider all factors having a bearing on present and probable future behavior of the fire. These are -- time of day; present direction, velocity and prevailing direction of wind; direction and steepness of slopes; fuel types at edge and ahead of fire; weather conditions and forecast for tomorrow; natural fire breaks; rate of line production and effect of men on the fire in retarding spread.

The ideal is to man the entire perimeter of the fire from the start.

Assign each sector boss, crew foreman and individual worker a specific piece of line sufficient to occupy him up to time set for corraling.

If number of men is inadequate to realize the ideal, or if parts of line do not require working, man accordingly, but still make specific job assignments on part to be manned.

Sector and crew assignments should be shorter and workers stationed closer together where fuels are heavier or spread is faster.

The head of the fire is usually the leeward or up-hill side. Hit that first and hardest, but safeguard the flanks and stop spread wherever there is danger of the fire getting away.

Method of attack

The three recognized methods in use in Region One are: Direct, Parallel, and Indirect. These have been so fully described in manuals and will be so fully covered in guard and foreman training, henceforth, that only a brief description of each is given here.

In deciding the most effective method to use on any fire or part of a fire, the man in charge must consider: nature of fuels, intensity of heat; rapidity of spread; skill of men in use of cutting versus digging tools, etc.

He will be governed by the fundamental principle that reduction of heat is the first aim, and that the direct method as used by the smokechaser on small fires is the fastest and safest wherever it is practicable to use it. On the other hand, he may be confronted with conditions on a few fires or sectors of large fires where the parallel or even the indirect method can be used to greater advantage. Again he may have conditions which favor the use of all methods on different parts of the same fire.

In general the direct method will be regarded as the favored one. It can be used to a much greater extent than in the past if crews are well handled, and will result in a decided saving in corral time and lost line.

THE DIRECT METHOD

Briefly, this consists of working directly at the edge of the fire, cooling with dirt or water where necessary, digging or scraping the burning edge of fine fuels into the fire, and putting out or cutting off and throwing in the burning ends of poles and logs. In this method the edge dug or scraped to mineral soil serves in place of a trench. On steep slopes below the fire it is necessary to dig a narrow deep trench just below the edge of the fire to prevent embers from rolling down when the edge of the fire is being scraped in or put out.

What is known as the two-foot method is recognized as distinct from other methods by some of the best authorities on the subject, but since it follows so closely the fire's edge and serves all the practical purposes of the direct method as well as requiring a thoroughly cooled fire, it hardly warrants a separate classification. Wherever the digging of a light trench from one to three feet from the edge of the fire is faster, just as safe, and will not greatly slow up the completion of the mop-up, that may be done in the application of the direct method.

Among the advantages of the direct method over other methods are:

1. The fire is cooled and made safer from the start, instead of being built up and made more dangerous as by other methods.
2. The work of corralling or checking spread by this method contributes directly to the mop-up job which it leads into naturally and effectively.
3. It permits saw crews to get inside to fell snags more quickly and otherwise reduces the danger of lost line.
4. It reduces the total amount of work and the elapsed time for both corral and mop-up.
5. There is proportionately less chopping and sawing and it is therefore better adapted to the CCC and pick-up type of labor available.
6. Does not require back firing of entire fire line which is often one of the most difficult problems encountered in other methods and is also sometimes dangerous.

THE PARALLEL METHOD

This consists of clearing away the brush, down logs and limbs on a strip alongside the fire, wide enough to stop the spread of the surface fire, and then digging or plowing a trench to stop the duff or ground fire. This line is then used as a base from which to fire out or remove the fuels from the intervening strip between it and the fire. Ordinarily, the strip between the line and the fire varies from two to ten feet wide, but often is wider for short distances due to irregularities in the fire's edge. Generally, it requires more work on the whole than does the direct method, cools the fire more slowly and is therefore not as safe, and delays mop-up including final release of men.

THE INDIRECT METHOD

This consists of building a line similar to that in the use of the parallel method, at a strategic location some distance ahead of or alongside the fire, and then backfiring from this line against the oncoming fire. It should be used only in emergencies, as a last resort when other methods are impracticable, or where it can be done with entire security both to cheapen control and to remove the fuels on recognized hazardous areas where controlled burning has been planned and approved by the Regional Forester.

HANDLING MEN

The output of held line per unit of man-power is discouragingly small. This can be traced not only to the useless work involved in the methods of fighting fire heretofore practiced but also largely to inefficient handling of men.

In the usual mechanics of fire line construction, men are worked in squads, one in clearing and another in trenching. Generally, there is little order or system to the movements of the men. Each man takes a bite in the clearing or trenching job wherever

he fancies, often getting in the way of others. Men bunch up following a natural tendency, and this results in lost motion, interference, and withheld effort on the part of those inclined to shirk and those who see a chance here to cover up or alibi. When a man finishes a piece of work he moves to the head of the line, interrupting the work of every man he passes and increasing the chances of accidents to still further curtail output.

That there is tremendous waste of these things is readily acknowledged by every one. Some foremen have developed methods of distributing and moving men that hold this waste to the minimum under the methods employed, but it is still too great. A change in method is, therefore, called for, and the one described below is made standard for this Region. It will be used except where clearly impracticable or more costly than the squad method, and will be taught at all foremen training camps so that foremen will be competent to use it wherever so directed.

The underlying principle is the assignment of a specific, marked piece of line for each man in the crew to build, except that men will be selected as saw crews the same as in the squad method, and for special jobs such as spot fires and hot spotting ahead of line construction. Before the men are distributed along the line, they are assembled at the point where their work is to begin, instructed in their part and responsibility, and given a pattern of the type of line work to be done. Each man is equipped with a shovel for cooling down the fire with dirt and scraping in the edge, and a Pulaski for trimming out brush and limbs, chopping small poles and digging trench where needed.

The distribution is made by having the strawboss lead the crew slowly out along the edge of the fire, the men being instructed to do no work until assigned by the foreman who drops them off from the rear of the line on marked sections. These sections will be equalized as to the quantity of work as nearly as the foreman can judge and of an average length decided upon beforehand to best suit the conditions in each case. This places individual responsibility on each man, shows up the loafers or misfits (prevents loafing almost entirely), prevents men passing or interfering with each other, and stimulates effort and pride of accomplishment.

The time of the foreman and the strawbosses is devoted to teaching and directing the men individually as they move back and forth, the strawbosses among their own squads and the foreman working through the strawbosses with the entire crew. This develops skill and positive leadership, the lack of which among foremen and leaders has been a serious handicap to output.

As the work of line construction nears completion on the individual sections some will finish before others. The foreman then has his choice of making adjustments by having the men who finish first help their neighbors or by having them go ahead on their own sections with essential mop-up jobs. The latter is generally preferable but the decision will be governed by the urgency of getting ahead and in either case there is not lost time.

The move ahead to a new section of line, in case the entire perimeter of the fire is not manned from the start, is made by picking up the entire crew progressively from the rear of the completed section, no man being allowed to pass another on the line. When the head of the completed line is reached the men are in line for redistributing to the new section in exactly the same way as was done in the first place. In nearly all instances it is desirable to organize mop-up work immediately behind line construction. For this work men are selected and assigned their beats before the crew is moved forward and a mop-up strawboss remains behind to supervise the work.

While this method of individual responsibility is especially suited to the direct method of attack, it is entirely practicable to the building of line under either of the other methods.

It calls for extra shovels and Pulaskis additional to those in standard fire outfits up to 24 each per 100 men (the number depending on the amount of sawing and snag felling to be done), and these should be ordered extra to suit the needs of each fire. However, if there is a shortage of tools, this system of handling is almost as effective by giving each alternate man a shovel and the next a Pulaski and then assigning the men to individual sections in teams of two men each.

It is not to be understood from the above that working men in squads is never to be done. Special squads for knocking down hot spots in heavy fuels and for other difficult jobs may be not only the best but sometimes the only effective way of getting them done. Forest officers and foremen are charged with the responsibility of understanding

both methods and when and how to apply each. The most that is asked in regard to the individual responsibility method is that it be fully tested out wherever it seems to be practicable and that it be used wherever output can be increased thereby. Its use on a much larger scale than in the past is certain to speed up held line construction and reduce costs and losses.

SPOT FIRES

Every fire may have one or more spot fires. If there is a snag burning, if trees have crowned out, or if there has been intense heat from any cause, spot fires are not only possible but likely.

As soon as the main fire has been sized up and initial action taken toward its suppression, a systematic search and plan for finding and handling spots should be made. This may be done by thorough scouting or combing of the area ahead of the fire coupled with lookouts from regular points or from points specially selected for that purpose.

If sparks or embers are falling a short distance across the line it is generally possible to prevent them from gaining headway by stationing men closely enough together to discover and put them out in their incipency. In many cases the rate at which the head of a fire travels is greatly enhanced by the "pick-up" of spot fires. Where it is safe for men to work ahead of a fire in such cases the spread may be materially retarded by treating only the spot fires, thereby confining the spread entirely to the edge of the solid burn. This is an emergency measure to be undertaken when the number of men is inadequate to handle both line construction and spot fires pending the arrival of help or of nightfall and where there are strategic reasons for holding back the progress of the fire as much as possible.

SNAGS

Burning snags are one of the firefighter's greatest troubles. They are a threat both to the fire line and to human life.

Sparks and embers from them blow across the line, often starting spot fires long distances ahead.

Burning bark and limbs may drop and roll across the line. Tops burn off, fall and roll, threatening the safety of workers. They burn out at the base and entire trunks fall across the line. Fire brands travel from snag to snag.

All dangerous snags must be felled as soon as practicable.

Often the area around a burning snag can be cooled sufficiently with dirt to permit sawing. Fire may often be kept out of unignited snags by clearing the ground around them.

Ordinarily 100 yards inside the line is a sufficient strip to clear of snags. Weather and wind conditions may increase the width necessary.

Snag fellers should where practicable work in front of or behind crews so that falling snags do not interfere with or endanger men.

Where snags or groups of snags are burning too hot to be cooled down for felling, men must patrol and search areas across the line to find and put out resulting spot fires. Sometimes fires may be prevented from occurring in rotten spots in snags or logs within reach, by covering over or packing with mineral soil.

MOP-UP TACTICS

Systematically organized mop-up immediately behind line construction will be considered standard performance, and any line lost due to failure to follow this practice will be hard to justify.

Mop-up is anything done that tends to make the fire safer after the control line is established and the spread stopped, or that tends to put fire out.

It should be directed first, and usually throughout the day of corralling, toward making the line secure, not by widening the clearing or the trench, but by working directly on burning fuels. Following are the important items in making line secure:

Take down burning snags, if any near the line.

Spread burning materials from near the line well back inside.

Turn logs out of their hot beds and fix them so they will not roll.

Separate accumulations of burning fuels or if that is not possible on account of heat, cool down with dirt until it can be done.

Suppress all flames with dirt.

Watch especially for intense heat at base of low branching trees and cool with dirt. Never trim off the branches to fall into the flames before cooling down.

Direct main efforts at or near the edge of the fire and make frequent observations to make sure there is no fire outside the line.

In organizing mop-up always give each man a definitely marked beat and appeal to his pride in holding it.

Give men specific individual instructions, and to the extent practicable, give reasons why doing certain things produce desired results.

After the line is absolutely secure, usually the second day, the purpose of mop-up is strictly to put fire out, and will be carried to the interior of the fire as well as along the edge.

The line having been made entirely secure the force is usually heavily reduced and each man is given a longer beat than during the first day of the mop-up job. This is justified, too, because if the initial work has been well done, much of the burning fuel will have gone out. Time, coupled with the coolness and humidity of the night air, are mighty factors in reducing the amount of burning fuels to be dealt with the second day. Some of the fine points in getting rid of fire quickly and cheaply are:

Select for first attention those fuels that are going to require the most time to put out, leaving that which will likely go out in the meantime without attention.

Don't try to put these stubborn fuels entirely out at once. Work back and forth along the line, keeping in touch with all of it, and not forgetting to watch outside the line, turning each piece of burning fuel, drenching with dirt, or scraping off the hot side, etc.

Allow time to help do the work until finally there is but a little fire left

and it will be so near out that a little work will finish the job. Never bury fire and leave it to go out. Keep it exposed so you know when it is out.

Scatter burning duff thinly over cold, burned-over ground. It can be put out quickly if need be by scraping in from the edge, spading up with dirt, mixing and remixing until dead out.

Finally, feeling with the hands wherever live fire is possible is the only way to make sure the fire is out.

WATER AND WATER EQUIPMENT

Means of using water on forest fires are many and varied.

Stationing men outside of established fire lines where sparks are falling rapidly, with a water bag and cup or tin can, has often proved a valuable method of putting out the small spots before they could get started.

The use of hand pumps and back-pack water bags or cans is sometimes advantageous in putting out fire in snags and helping to cool down fires.

Tank trucks and railroad tank cars equipped with pumps are especially valuable for quick action along highways, railroad right of ways and on slash fires in logging operations.

When fires occur along motor ways or pack trails, water equipment units have to be transported by truck or pack train to the end of such transportation and sometimes back-packed to the fire or source of water supply. The standard equipment in Region One is the Pacific pumper and accessories.

The pumper and accessories are packed in two boxes and make a load for one pack animal.

The Pacific pumper is a gasoline engine and a pump built in one unit weighing about 70 pounds and is capable of pumping 40 gallons per minute at 100 pounds pressure. The engine is 4 cylinder, 2 cycle, water cooled and develops 5 to 6 horsepower. One and one-half inch light weight special forestry hose or one and one-half inch light weight

linen hose is used. The forestry hose weighs 27 pounds per 100 feet and the linen hose 13 pounds per 100 feet. Instructions for use is included in the box with the pumper. If they are followed carefully no difficulty will be experienced in using the unit.

It usually is not possible or wise to include the use of water in the first plan of attack on a fire and the decision to use it should be made only after an analysis of the conditions show distinct advantages. It must be remembered that nearly everything that can be done with water can also be done, little leff effectively, with dirt which is practically always easily available.

Obstacles to the use of water are:

No water supply is available on 90% of fires.

Availability is usually not known until the fire is reached.

Time, labor and cost of getting water to fire is often excessive.

It is difficult to secure men experienced in its use.

There is possibility of tying up a force of men to the detriment of extending control line.

Use of water does not rob the fire of fuel, prolongs the burning out period and may give a false sense of security.

Many of these disadvantages are not present in the case of fires along highways, railroad right of ways and slashing fires in logging areas and plans made in advance may be based on the use of water, power pumpers, tank cars, tank trucks, and other water equipment.

Water and water equipment have proved valuable to hold small streams, roads and trails as fire lines. Water is useful to cool down areas around snags so that sawyers can get to them, to cool hot spots under trees to prevent crowning, to check rapidly running surface fires and to wet areas outside established lines where danger of fires starting across the line is present.

The tendency of nozzle men to waste water has to be combatted at all times. An inexperienced nozzle man can easily waste 80% of the water delivered.

The pump crew should consist of pump man, nozzle man and two men on the hose line when 1500 feet of hose are used. The addition of one man for each 1000 feet of

of hose is sufficient.

Except for cooling down necessary hot fires, it is better to let the fire burn such material inside the lines as will readily be consumed before starting the use of water there.

Use of Water in Mop-up

With a fire line completed around the fire and much of the duff and surface fuels consumed inside the fire, leaving a large percentage of the inside area clean burned, water may be used to good advantage in mopping up the remaining fire.

Where stumps, snags, logs, hollow cedars and other heavy fuels are burning, nozzle men should not attempt to put them out with one soaking. The practice of returning and soaking them at intervals is the surest and quickest way to completely extinguish the fire in them.

Snags must be drenched from all sides starting at the highest fire and working down.

One or more men with shovels and Pulaskis should work with the nozzle man to dig out and open up persistent pockets, tear rotten logs apart and turn deep duff.

LAYING OFF CREWS

Following the time of corralling a fire, ordinarily before 10 a.m., it is generally advisable to keep the entire crew throughout the danger period of that day and use the men in a thorough well-organized mop-up aimed at making the line more and more secure.

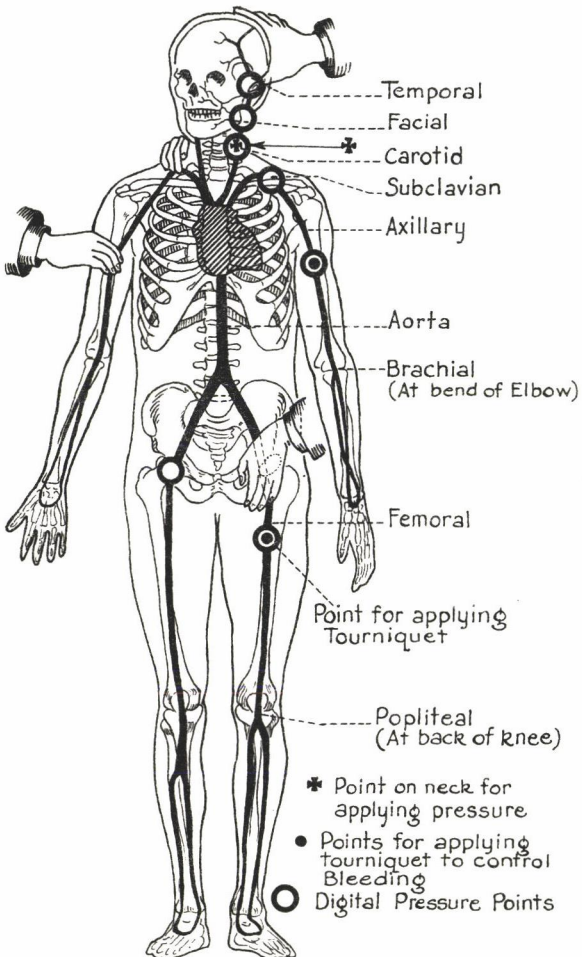
If no line is lost and no unusual hazards exist at the end of the day a substantial reduction, up to 50 or even 75 per cent, may be made for the next day. This will be determined by a careful estimate of the mop-up work still to be done and of the number of men required to do it most economically consistent with entire safety.

Each night thereafter a re-estimate of the man-power needs for the succeeding day will be made as a basis for further reduction of the force from day to day.

DIGITAL & TOURNIQUET PRESSURE POINTS

WOUNDS

100

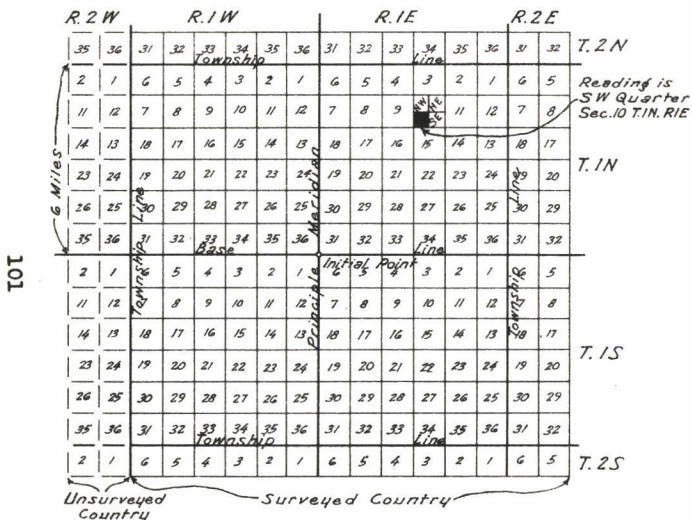


Skeleton with main arteries and pressure points

NUMBERING TOWNSHIPS AND RANGES

Diagram showing the layout of a map which is extended from the initial point in any given State.

Diagram shows how Ranges are numbered east and west of principal Meridian, and how Townships are numbered north and south of the base line. Shows how Sections are numbered within the Townships, and how numbered in short Townships, both east and west and north and south of the two lines.



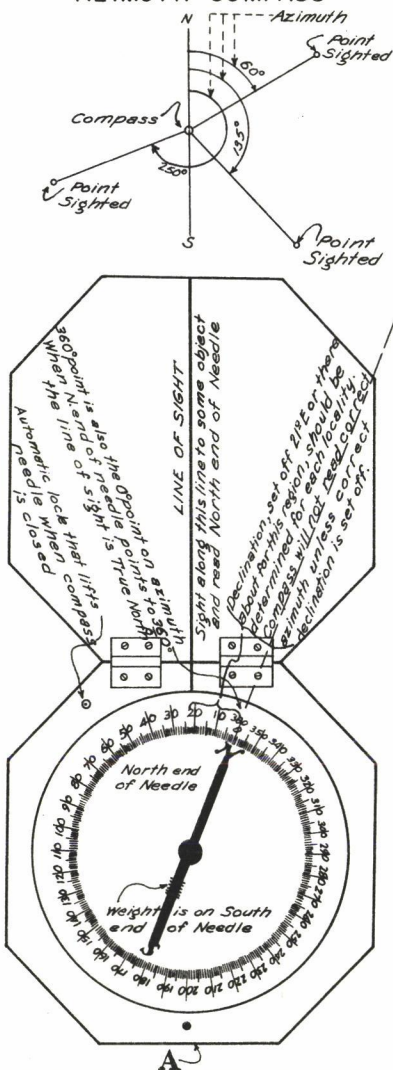
The top of the map is always north.

Maps used on lookouts are 1/2 inch to the mile, or 1/2 inch on the map represents 1 mile on the ground, 1/2 inch square on the map is 1 Section.

Area of full Township, 23,040 acres. Area of full Section, 640 acres. Due to various reasons these acreages may be greater or less.

Townships and Sections do not continue across a State line, but are numbered from an initial point (see above) in that State.

INSTRUCTIONS FOR USE OF FIREMAN'S AZIMUTH COMPASS



INSTRUCTIONS FOR USE OF FIREMAN'S AZIMUTH COMPASS

The Azimuth of any point is the angle which the line (from the compass to the point sighted) makes with a north and south line when measured clockwise from the North.

Set the compass level on a log or stump with the edge or side A toward you, needle swinging free and no metal near or on your person to attract it.

Sight along line on cover to object or point and ALWAYS read the North (non weighted) end of the needle. This will give the true azimuth reading if the declination, (difference between true North and magnetic North has been properly set off as shown in drawing. Check with district ranger to see that declination is correct.

Common Mistakes to Avoid:

Reading wrong end of needle.

Not releasing or letting needle down on pivot.

Reading wrong side of numbered divisions e g, 61° instead of 59°.

The numbering of the degree graduations on the azimuth plate are counter clockwise in order that the azimuth may be read directly.

Directions for taking backsight readings from a given Azimuth reading.

- (1) When azimuth reading from lookout to fire is less than 180°, add 180° to azimuth reading.

EXAMPLE:-

Reading from lookout to fire = 132°
Therefore backsight reading is 132°
plus 180° = 312° on compass.

- (2) When azimuth reading from lookout to fire is 180° or more subtract 180° from azimuth reading.

EXAMPLE:

Lookout reading from lookout to fire
= 310°
Therefore backsight reading is 310°
minus 180° = 130° on Compass.

- (3) When the north end of the needle is on the azimuth reading the south end points to the backsight reading.
Check this by computation (1) or (2).

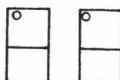
Fuel

SUGGESTED CAMP LAY-OUT

Open Fire



Stoves--Note: One stove up to 50 men.



Two stoves 75-200 men.

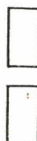
Food Supply



Kitchen Equipment

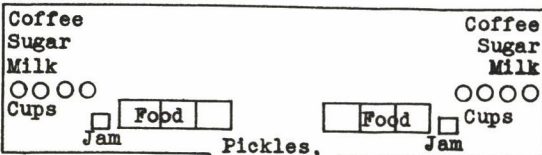
Cooks Work Table
3' X 6" - 30" High

Boxes For Garbage, Dirty Dishes



Dish-Up Flunkies

16 to 20 Feet



Double-line feeding Kitchen
(50-200 men)

Crew men help selves to plates, silverware, bread, butter, etc. Flunkies serve hot food and coffee.

6 to 8 Feet

Pickles, Butter Etc.

Bread
Spoons
Forks
Knives
Plates

24" to 30" Wide

Feed line 1/2 on each side

Filled dishes are sent from line in opposite directions thus eliminating the congestion of a single line table.

